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Third Edition

Volume 3

THE SOCIETY OF DYERS AND COLOURISTS

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

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MORDANT DYES

The area covered by this section is that embracing the dyes sold by their makers under such names as mordant dyes, chrome dyes, metachrome dyes, afterchrome dyes, chrome printing colours, etc. Its make-up is a matter not of strict definition but of convention, a convention that has developed during the years and which has little logical basis, e.g. it does not include the basic dyes which are dyed on tannin–antimony mordanted cotton nor does it include those cotton dyes which, like afterchrome dyes on wool, do not develop their true hue and/or fastness properties till their dyeings have been treated with a metallic salt.

The majority of dyes in this section find their sole or main use in wool dyeing but some have important secondary uses for dyeing silk, nylon, leather and anodised aluminium, in Vigoureux printing and in the printing of wool, silk and cellulosic fabrics, some being used solely for textile printing or for dyeing leather or anodised aluminium. A few are used in the production of pigments while others find some use in the colouring of paper, as biological stains and indicators and in fur dyeing.

The methods by which a particular dye may be applied are listed under the headings Dyeing Wool; Dyeing: Other Fibres; Printing and Non-textile Usage and no significance should be given either to the order of these headings or to that on the individual listings under these headings as these are purely arbitrary or alphabetical. The headings for the Fastness Properties, viz. Wool (1), Wool (2) and Wool (3) indicate wool dyed by the afterchrome, metachrome or on-mordant process respectively. Where the fastness properties are not given for dyeings or prints by all the methods by which a particular dye may be applied it indicates that those methods for which such properties are not given have not achieved commercial importance. In those cases where fastness properties for a particular method were given in the Second Edition but do not appear in this Edition the method concerned has lost the commercial importance it had a couple of decades ago, so far as the particular dye is concerned.

The abbreviations used to indicate the staining of effect fibres in wool dyeing are *u*—unstained, *vss*—very slightly stained, *ss*—slightly stained, *s*—stained, *hs*—heavily stained and *d*—dyeing. In assembling the data for these dyes it has proved impossible in many cases to reconcile the statements made by different makers of the same dye with regard to its staining properties for other fibres in wool dyeing and there is no doubt that marked differences do exist in some cases between different makers' productions of the same dye. There are several reasons to account for this, e.g. different makers may arrive at the same product by different steps with consequent differences in impurities and so in staining properties. Where a clear indication of staining properties is given it means that all makers are in substantial agreement but where a vague indication is given, e.g. *u–hs* or *ss–hs*, then it means that the various makes do differ within the range indicated.

The fastness tables are self explanatory, with the proviso that milling when unqualified is to be read always as alkaline milling, and to a very large extent indicate the purposes for which the dye is suitable. Where fastness to borax clearing is given, this means fastness to treatment with 0·1 % aqueous borax for one minute at the boil. This gives an indication of the fastness of the dyeing to the borax scour often given to hats to free them from surface deposits of shellac after stiffening.

Under non-textile usage the mention of a substrate, e.g. anodised aluminium or paper, with little or no further comment indicates that at least one maker has reported that there is commercial usage of the dye on that substrate but that no details about the mode of application have been supplied to the Editorial Board. "See Leather Dyes section" indicates that particulars about the dye's usage on leather appear in the Leather Dyes section in Volume 2.

LITERATURE

The use of mordant dyes is very ancient—most natural dyes are mordant dyes—so that the literature on their application goes very far back and is most voluminous. For many purposes the older textbooks are as useful as the more modern. The manuals and pattern cards of the various manufacturers are especially useful and the recent issues of their pattern cards reveal the latest developments in dyes and in the techniques of their application in a manner which no text book can achieve. The following books are particularly useful:

Bird, C. L., *The Theory and Practice of Wool Dyeing*, 3rd Edn, Bradford (Society of Dyers and Colourists, 1963)

Knecht, E., and Fothergill, J. B., *The Principles and Practice of Textile Printing*, Revised by J. G. Hurst, London (Griffin, 1952)

C.I. Mordant Yellow	1	2	3
CHEMICAL CLASS	Monoazo		Monoazo
C.I. CONSTITUTION NUMBER	**14025**		**14095**
HUE: Daylight	Dull Yellow (Cr)*	Yellow	Dull Yellow
Artificial light (tungsten)	Brighter and redder	Slightly redder	Slightly redder
DYEING: WOOL	1, 2, 3	3	1, 2, 3
Staining other fibres	In all three methods: Cellulose and Acetate: *u—hs*, Silk: *ss—hs*		In afterchrome dyeing: Acetate and Cellulose: *u—ss*
DYEING: OTHER FIBRES	Nylon: Afterchrome Silk: Mordant		Nylon: Afterchrome Silk: Afterchrome
PRINTING	Wool, Silk and Cotton: Cr mordant Cotton print fastness: Chlorine 4–5; Light 4, 5, 5; Washing 4, 4		Wool: Cr acetate, Chromate. Silk: Chromate Cotton: Cr mordant — Fastness: Chlorine 4; Light 3, 4, 5; Washing 3–4

FASTNESS PROPERTIES ETC.

Method	AATCC	ISO	ISO	ISO	AATCC	ISO	ISO
Substrate	Wool (1)	Wool (1)†	Silk (3)	Wool	Wool (1)	Wool (1)*	Silk
Alkali	3–4	3–4	—	4–5	4–5	4	—
Cross Dyeing Wool Acetic/Sulphuric	3/1	3–4/1–2	1–2/2–3	—	4/3	3/2–3	1/2
Carbonising	3–4	3–4	—	—	3	3	—
Chlorination	—	3–4	—	—	—	3–4	—
Decatising	4	4	—	—	5	5	—
Hot Pressing	3	3–4	—	3	4	4	5
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	4	4	4	—	4	4	3
normal	5–6	4–5	4–5	5	5	4–5	3–4
2× normal	6	5	5	—	6	5	4
Milling: Alkaline	—	4	4–5	—	4–5	4	3
Acid	4–5	2–3	—	—	—	2	—
Peroxide Bleaching	2	2	1–2	—	2–3	3–4	3–4
Perspiration	4–5	4	4–5	5	3–4	4	5
Potting	2–3	2–3	—	—	5	2–3	—
Sea Water	4, 4	4	—	—	4	4	—
Stoving	2–3	3	2	—	1–2	1–2	5
Washing	4	4	4–5	4–5	4–5	4	5
Water	4–5	4–5	4–5	5	5	5	5
Dischargeability	Dischargeable to white			—	Dischargeable to white		
Metal in dyebath: Copper	—			—	Greener		
Iron	—			—	Redder and duller		
Solubility	—			—	Soluble in cold water		

NON-TEXTILE USAGE	Anodised aluminium Biological stain Indicator See Leather Dyes section		Anodised aluminium Cellulosic moulding powders Lakes Leather
REACTIONS			On wool: HNO_3 conc.—pale yellow spot, red rim
NOTES	*Dull Greenish Yellow (CrF_3 after treatment) Bright Yellow (Al) †Wool (2) and (3) similar but light fastness is slightly lower and that to stoving is slightly higher		Fur hat bodies—borax clearing 4 *Wool (2) and (3) very similar

C.I. Mordant Yellow	4	5	6
CHEMICAL CLASS	Azo		Monoazo
C.I. CONSTITUTION NUMBER		14130	
HUE: Daylight	Dull Reddish Yellow		Dull Greenish Yellow
Artificial light (tungsten)	Little change		Little change
DYEING: WOOL		1, 2, 3	—
Staining other fibres		Afterchrome and mordant dyeing: Acetate and Cellulose—*u*	Slightly different chemically from but very similar in properties and uses to C.I. Mordant Yellow 5
DYEING: OTHER FIBRES	Silk: Chromium lactate mordant Cotton: Pad with chromium lactate	Nylon: Afterchrome Silk: Afterchrome, Metachrome	
PRINTING	Wool and Silk: Chromium lactate + urea + glycerine Cotton: Chromium acetate mordant	Wool, Silk and Cotton: Chromium mordant. Vigoureux printing Cotton print fastness: Chlorine 2–3; Light 4, 5, 6, Washing 4	

FASTNESS PROPERTIES ETC.

Method	ISO		AATCC	ISO*
Substrate	Cotton	Silk	Wool (1)	Wool (1)
Alkali	—	—	5	4
Cross Dyeing Wool Acetic/Sulphuric	—	—	4/2	4/2–3
Carbonising	—	—	3	3
Chlorination	4*	—	—	4
Decatising	—	—	5	5
Hot Pressing	—	—	5	4–5
Light: ⅛–¼ normal	4–5	5	6	5
normal	5–6	6–5	6–7	6
2× normal	6	6	8	6–7
Milling: Alkaline	—	5	4	4–5
Acid	—	—	—	2–3
Peroxide Bleaching	—	—	2	3
Perspiration	—	5	5	4–5
Potting	—	—	4–5	4
Sea Water	—	—	5	5
Stoving	—	—	1	4
Washing	—	—	5	5
Water	5 (100°C)	5	5	5
Dischargeability	Dischargeable to white		Not suitable	
Metal in dyebath: Copper	—		Slight effect	
Iron	—		Much altered	
Solubility	—		Suitable for package dyeing	

NON-TEXTILE USAGE		See Leather Dyes section	
REACTIONS			
NOTES	*Chlorine	*Wool (2) and (3) very similar	

7	8	9	C.I. Mordant Yellow
	Monoazo	Monoazo	CHEMICAL CLASS
	18821	14190	C.I. CONSTITUTION NUMBER
Dull Yellow Little change	Yellow→Reddish Yellow Brighter and redder	Dull Yellow→Reddish Yellow Redder and brighter	HUE: Daylight Artificial light (tungsten)
1, 2 —	1, 2, 3 Cellulose and Acetate—*u*	1 Cellulose and Acetate—*u*, Silk—*s*	DYEING: WOOL Staining other fibres
	Silk: Afterchrome		DYEING: OTHER FIBRES
Silk Cotton	Wool and Silk: Cr mordant. Wool print fastness (ISO): Milling 4–5, Stoving 4–5, Washing 5. Vigoureux printing and for illuminating in coloured tin discharges		PRINTING

ISO		AATCC	ISO		ISO	FASTNESS PROPERTIES ETC.
Wool (1)	Wool (3)	Wool (1)	Wool (1)*	Silk	Wool	Method
—	—	4–5	4–5	—	4	Substrate
—	—	4/2	2–3/2–3	2/2	—	Alkali
—	—	4–5	5	—	2–3	Cross Dyeing Wool Acetic/Sulphuric
—	—	4–5	4–5	—	—	Carbonising
—	—	5	5	—	5	Chlorination
						Decatising
—	—	4–5	4	4	4	Hot Pressing
—	—	5	6–7	6	—	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
6	5	7	7	6–7	4–5	normal
—	—	7–8	7–8	7	—	2× normal
5	4–5	4	4–5	2	4	Milling: Alkaline
—	—	—	3	—	—	Acid
—	—	4	3–4	2–3	—	Peroxide Bleaching
5	5	4–5	4–5	2–3	5	Perspiration
4	3	2–3	3	—	3	Potting
—	—	4, 5	5	—	—	Sea Water
—	—	4–5	4–5	4–5	—	Stoving
5	5	4–5	4–5	3	4	Washing
5	5	4–5	4–5	3	4–5	Water
—		Dischargeable to white			Not dischargeable to white	Dischargeability
—		Much greener			—	Metal in dyebath: Copper
—		Much redder			—	Iron
—		—			—	Solubility

Leather: On chrome tannage	See Leather Dyes section		NON-TEXTILE USAGE
			REACTIONS
	*Wool (2) and (3) very similar		NOTES

C.I. Mordant Yellow	10	11	12
CHEMICAL CLASS	Monoazo	Azo	Monoazo
C.I. CONSTITUTION NUMBER	**14010**		**14045**
HUE: Daylight	Dull Greenish Yellow	Dull Yellow	Bright Yellow
Artificial light (tungsten)	Slightly redder	Redder	Weaker, slightly redder
DYEING: WOOL	1, 2, 3	1, 2	1, 2, 3
Staining other fibres	Acetate and Cellulose—*u* by all three methods		Cellulose and Acetate—*u* by all three methods
DYEING: OTHER FIBRES	Nylon: Afterchrome Silk: Afterchrome, Mordant	Silk: Afterchrome	Nylon: Afterchrome Silk: Mordant
PRINTING	Wool, silk and cotton: Chromium acetate Cotton print fastness: (ISO) Chlorine 4–5; Light 4, 5, 5; Washing 3		Wool and Cotton: Cr mordant

FASTNESS PROPERTIES ETC.

Method	AATCC	ISO		ISO	ISO		ISO	
Substrate	Wool (1)	Wool (1)*	Silk (1)	Wool (1)	Wool (2)*		Silk	
Alkali	5	3–4	—	5	4		—	
Cross Dyeing Wool Acetic/Sulphuric	3–4/1–2	4–5/1–2	3/3–4	—	1–2/1		2/1–2	
Carbonising	4	2–3	—	—	2		—	
Chlorination	3–4	4–5	—	—	3–4		—	
Decatising	5	5	—	—	4		—	
Hot Pressing	4–5	4–5	4–5	—	4		3–4	
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	4–5	4	4	—	3–4		3–4	
normal	6	5	5	5–6	4		4	
2× normal	7	5	5	—	4–5		4–5	
Milling: Alkaline	4–5	4–5	4	5	5		4	
Acid	—	4	—	—	3		—	
Peroxide Bleaching	2	4–5	1	—	2		1	
Perspiration	4	4	1–2	—	4		4–5	
Potting	3–4	2–3	—	—	2–3		—	
Sea Water	4–5	4–5	—	—	4		—	
Stoving	2	4–5	4–5	3	2		1–2	
Washing	4–5	4–5	3–4	5	5		4–5	
Water	5	5	5	—	5		4	
Dischargeability	Fairly good			—	—	—	—	
Metal in dyebath: Copper	Duller			Slightly duller	3 (1)	4 (2)	3–4 (3)	
Iron	Much redder and duller			Browner	1–2 (1)	3 (2)	3 (3)	
Solubility	Very soluble in cold and hot water			Good	—	—	—	

NON-TEXTILE USAGE	See Leather Dyes section	Leather: On chrome tannage	See Leather Dyes section
REACTIONS			On wool: HNO_3 conc.—yellow spot, bluish red rim
NOTES	*Wool (2) and (3) similar		Resistant to formaldehyde *Wool (1) and (3) similar

13	14	15	C.I. Mordant Yellow
Monoazo	Monoazo		CHEMICAL CLASS
	14055		C.I. CONSTITUTION NUMBER
Greenish Yellow	Dull Greenish Yellow	Bright Yellow	HUE: Daylight
Redder	Slightly redder	Little change	Artificial light (tungsten)
1, 2, 3	1, 2, 3	1	DYEING: WOOL
Afterchrome: Acetate and Cellulose—*u*, Nylon—*s*, Silk—*ss*	Afterchrome and Metachrome: Cellulose—*u–ss*	Acetate and Cellulose—*ss*, Nylon and Silk—*hs*	Staining other fibres
	Silk: Afterchrome, must be well soaped Nylon: Afterchrome, Metachrome Cotton: Fastness Chlorine 3–4, Light 4, Washing 3–4		DYEING: OTHER FIBRES
	Wool, Silk and Nylon: Cr mordant		PRINTING

AATCC Wool (1)	AATCC Wool (1)	ISO Wool (1)*	ISO Silk	ISO Wool	FASTNESS PROPERTIES ETC.
					Method
					Substrate
2–3	4–5	3	—	4	Alkali
—	3/–	—	—	–/3	Cross Dyeing Wool Acetic/Sulphuric
4	3	3	—	4	Carbonising
—	—	2–3	—	—	Chlorination
3–4	4	4	—	5	Decatising
3–4	dry 2 wet 5	5	5	4	Hot Pressing
—	4	3	—	4	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
4	5	3–4	3–4	5	normal
—	6	4–5	—	5–6	2× normal
3	4	3–4	3	4–5	Milling: Alkaline
—	—	—	—	—	Acid
—	2	2–3	3	3	Peroxide Bleaching
3–4	3, 3	3	4	4	Perspiration
3–4	4	1–2	—	5	Potting
4	4, 2	3	—	5	Sea Water
2–3	3	2	4	3	Stoving
3	4	4	4	5	Washing
—	5	3–4	5	5	Water
—	Dischargeable to white			Not disch. to white	Dischargeability
Duller	Slightly duller			Unaffected	Metal in dyebath: Copper
Very little effect	Duller			Much redder	Iron
Soluble in cold and hot water	—			Very good	Solubility

	Leather: On chrome and vegetable tannages		NON-TEXTILE USAGE
In substance: H_2SO_4 conc.— yellow, on diln — yellow ppt. On wool: HNO_3 conc.— dark red	On wool: HNO_3 conc. — pale yellow spot, fuchsin rim		REACTIONS
	*Wool (2) and (3) similar		NOTES

C.I. Mordant Yellow	16		17	18		
CHEMICAL CLASS	Disazo		Azo	Monoazo		
C.I. CONSTITUTION NUMBER	**25100**			**13990**		
HUE: Daylight	Dull Reddish Yellow		Dull Reddish Yellow	Dull Greenish Yellow		
Artificial light (tungsten)	Little change		Slightly redder	Slightly redder		
DYEING: WOOL	1, 2, 3		1, 3	1, 2, 3		
Staining other fibres	Afterchrome: Acetate and Cellulose —*ss–hs* Metachrome and mordant: Acetate—*ss*, Cellulose—*vss*		Afterchrome: Acetate and Cellulose—*u*	Afterchrome: Acetate—*ss–hs*, Cellulose—*u–ss* Metachrome and Mordant: Acetate—*vss*, Cellulose—*u*		
DYEING: OTHER FIBRES			Nylon and Silk: Afterchrome	Nylon: Afterchrome Silk: Mordant		
PRINTING	Wool, Silk and Cotton: Cr mordant Vigoureux printing		Wool: Chromium acetate	Wool and Cotton: Cr mordant Cotton print fastness: Chlorine 4–5; Light 4, 5, 5; Water 3		
FASTNESS PROPERTIES ETC.						
Method	AATCC	ISO	ISO	ISO		
Substrate	Wool (1)	Wool (1)*	Wool (1)	Wool(1)	Wool(2)	Wool(3)
Alkali	3–4	4	5	4	4–5	4–5
Cross Dyeing Wool Acetic/Sulphuric	4/3	4/3	–/1–2	5/1–2	4–5/1	5/1
Carbonising	3	4	5	2–3	3	1–2
Chlorination	—	4–5	4–5	4–5	4–5	4–5
Decatising	5	5	5	5	5	5
Hot Pressing	3	4–5	—	4–5	4	4
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	5	4	4–5	—	—	—
normal	6	4–5	5	6	5–6	6
2× normal	7	5	5	—	—	—
Milling: Alkaline	5	4–5	5	4–5	4–5	4–5
Acid	—	2–3	2	—	—	—
Peroxide Bleaching	2	4	4	4	4	3–4
Perspiration	5	4–5	4	4	5	4–5
Potting	5	4–5	5	2	1	1
Sea Water	4–5	5	—	4–5	4–5	4
Stoving	2–3	3	1	4–5	3	4
Washing	4–5	4–5	5	4–5	4–5	4–5
Water	—	5	5	5	5	5
Dischargeability	Dischargeable to white		Not dischargeable	—		
Metal in dyebath: Copper	Slightly greener		2	5		
Iron	Redder, duller		2	4–5		
Solubility	—		Good	—		
NON-TEXTILE USAGE	See Leather Dyes section Fur for hats — borax clearing 5			See Leather Dyes section		
REACTIONS	On wool: HNO_3 conc. — very pale yellow spot, reddish grey rim U.v. radiation — rich reddish brown					
NOTES	*Wool (2) and (3) very similar					

19	20	21	C.I. Mordant Yellow
Azo	Monoazo 14110	Disazo 23130	CHEMICAL CLASS C.I. CONSTITUTION NUMBER
Bright Greenish Yellow	Dull Reddish Yellow Brighter and redder	Reddish Yellow	HUE: Daylight Artificial light (tungsten)
1 Acetate—*u*, Cotton—*u*, Silk—*hs*	1, 3 Afterchrome: Acetate and Cellulose—*u*, Nylon—*d*, Silk—*u–ss*	1, 2, 3 Afterchrome: Acetate—*hs*, Cellulose and Silk—*ss*	DYEING: WOOL Staining other fibres
			DYEING: OTHER FIBRES
Wool: Chromium acetate, Chromate Silk: Chromate	Wool, Silk and Cotton: Chromium acetate Vigoureux printing		PRINTING
ISO Wool (1) 4 –/4–5 5 — 5 5 5 6 6 3–4 4–5 — 5 3–4 — 5 4 — 4 4 2 —	AATCC Wool (1) 5 4/– 4 — 4 4 5 6 7 4–5 — 2 5 4–5 5 2 5 5 Dischargeable to white Unaffected Somewhat altered —	ISO Wool (1) 3 –/2–3 3 4 3–4 4 4–5 5 4 — 3–4 5 2–3 4 2 5 5	ISO Wool (1) 4–5 –/3 4 — 4–5 5 5 5–6 6 4 — — 5 4 4–5 4 4–5 5 — 4–5 2–3 —	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
	See Leather Dyes section		NON-TEXTILE USAGE
			REACTIONS
			NOTES

C.I. Mordant Yellow	22	23
CHEMICAL CLASS		Azo
C.I. CONSTITUTION NUMBER		
HUE: Daylight	Bright Greenish Yellow	Dull Yellow
Artificial light (tungsten)	Redder	Little change
DYEING: WOOL	1, 2, 3	1, 2
Staining other fibres	All methods: Acetate and Cellulose—*ss*, Silk—*hs*	Metachrome: Cotton—*u*, Silk—*ss*
DYEING: OTHER FIBRES		Nylon: Afterchrome, 90–120 min boil for lake formation
PRINTING		Wool: Chromium acetate
FASTNESS PROPERTIES ETC.		
Method	ISO	ISO
Substrate	Wool (1)*	Wool (1) / Wool (2)
Alkali	4	4–5 / 4–5
Cross Dyeing Wool Acetic/Sulphuric	—	–/2–3 / –/2–3
Carbonising	1	5 / 5
Chlorination	—	4–5 / 4–5
Decatising	4	5 / 5
Hot Pressing	5	— / —
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	3–4	4–5 / 4
normal	4	5 / 4–5
2× normal	4–5	5–6 / 5
Milling: Alkaline	5	5 / 5
Acid	—	2 / 2
Peroxide Bleaching	—	3 / 3
Perspiration	3–4	4–5 / 4
Potting	1	5 / 5
Sea Water	5	— / —
Stoving	3	4 / 3–4
Washing	5	5 / 5
Water	—	5 / 5
Dischargeability	—	Not dischargeable
Metal in dyebath: Copper	—	3
Iron	—	1 (Afterchrome) 4 (Metachrome)
Solubility	Soluble in cold water	Suitable for package dyeing
NON-TEXTILE USAGE		Anodised aluminium
REACTIONS	On wool: HNO_3 conc. — yellow spot, red rim U.v. radiation — dark olive	
NOTES	*Wool (2) and (3) very similar	

24	25	C.I. Mordant Yellow
Monoazo **14020**		**CHEMICAL CLASS** **C.I. CONSTITUTION NUMBER**
Dull Yellow→Dull Reddish Yellow Somewhat redder	Reddish Yellow→Orange Redder	**HUE:** Daylight Artificial light (tungsten)
1, 2, 3 All three methods: Acetate and Cotton—*u*, Viscose—*ss* Afterchrome: Silk—*ss*	1, 2, 3 All three methods: Acetate—*u*, Cellulose—*ss*, Silk—*hs*	**DYEING: WOOL** Staining other fibres
		DYEING: OTHER FIBRES
Wool, Silk and Cotton: Cr mordant		**PRINTING**
ISO Wool (1) 4–5 –/1 3 5 4–5 3 4 4–5 5 4 — 3 — 3–4 5 2–3 4–5 5 Dischargeable to white Little change (1) weaker (2) unchanged (3) Duller (1) and (2) unchanged (3) —	ISO Wool (1) 5 — 4 — 5 4 3–4 4 4–5 4 — — 3–4 3 5 4 5 — — — — Soluble in cold water	**FASTNESS PROPERTIES ETC.** Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
		NON-TEXTILE USAGE
	In substance: H_2SO_4 conc.—deep bluish red, on diln.—red to yellow. On wool: HNO_3 conc.—yellow spot, faint reddish grey rim	**REACTIONS**
	*Wool (2) and (3) very similar	**NOTES**

C.I. Mordant Yellow	26	27
CHEMICAL CLASS	Disazo	Monoazo
C.I. CONSTITUTION NUMBER	22880	14180
HUE: Daylight	Dull Yellow	Dull Yellow
Artificial light (tungsten)	Redder	Slightly redder
DYEING: WOOL	1, 2, 3	1
Staining other fibres	Afterchrome: Acetate—*u*, Cellulose—*ss*	Acetate and Cellulose—*u*, Silk—*hs*
DYEING: OTHER FIBRES	Silk and Nylon: Afterchrome Cotton: Chromium Acetate, Chromate	
PRINTING	Wool, Silk and Cotton: Chromium acetate, Chromate Vigoureux printing Wool print fastness (ISO): Milling 5, Washing 4–5 Cotton print fastness (ISO): Chlorine 4–5; Light 4–5, 6–7, 7; Washing 5	
FASTNESS PROPERTIES ETC.		
Method	AATCC	ISO
Substrate	Wool (1)	Wool (1)
Alkali	2	5
Cross Dyeing Wool Acetic/Sulphuric	5/3	4/2
Carbonising	4	4–5
Chlorination	—	1–2
Decatising	—	5
Hot Pressing	dry 3 wet 5	5
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	6	3
normal	7	4
2× normal	7–8	4–5
Milling: Alkaline	4	5
Acid	—	2
Peroxide Bleaching	3	1–2
Perspiration	5, 2	5
Potting	4–5	3
Sea Water	5, 4	5
Stoving	2	3–4
Washing	4	5
Water	5	5
Dischargeability	Dischargeable to white	Fairly good
Metal in dyebath: Copper	Unaffected	Duller
Iron	Much redder and duller	Much duller
Solubility	—	—
NON-TEXTILE USAGE	Leather: On chrome tannage	
REACTIONS	On wool: HNO_3 conc. — orange On cotton: HNO_3 conc. — deep bluish red	
NOTES		

28	29	C.I. Mordant Yellow
Monoazo 14090	Monoazo	CHEMICAL CLASS C.I. CONSTITUTION NUMBER
Dull Reddish Yellow Little change	Greenish Yellow Slightly redder	HUE: Daylight Artificial light (tungsten)
1, 2, 3 Afterchrome: Acetate—*u*, Cellulose—*ss*, Mordant: Acetate and Cellulose—*u*	1, 3 Afterchrome: Acetate and Cellulose—*u*	DYEING: WOOL Staining other fibres
Silk: Afterchrome, Mordant	Nylon and Silk: Afterchrome	DYEING: OTHER FIBRES
Wool, Silk and Cotton: Chromium acetate		PRINTING
ISO Wool (1)* / Silk (1)† 1 / — 3–4 / — 3 / — — / — 5 / — 2–3 / 5 4 / — 4–5 / 4 5 / — 4–5 / 4 — / — 2–3 / 3 5 / 4 2–3 / — 5 / — 2 / 5 4–5 / 5 5 / 5 —	AATCC Wool (1) 4–5 — 3 — 5 4–5 4 5 6 4–5 — 3–4 4–5 3 5 2 4 5 Not dischargeable	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability
Duller (1) and (2) Much redder and duller (1), much browner (2) —	Unaffected Redder and duller Excellent	Metal in dyebath: Copper Iron Solubility
Leather	Leather: On chrome and vegetable tannages; penetration good	NON-TEXTILE USAGE
	In substance: H_2SO_4 conc.—orange, on diln —orange soln and yellow ppt.	REACTIONS
*Wool (2) similar except for Perspiration 3–4, Sea water 3–4 and water 4 †Silk (2) similar except for Hot Pressing 3–4, Milling 5, Peroxide bleaching 5 and Perspiration 5		NOTES

C.I. Mordant Yellow	30	31
CHEMICAL CLASS	Monoazo	Monoazo
C.I. CONSTITUTION NUMBER	18710	*
HUE: Daylight	Dull Reddish Yellow	Yellow
Artificial light (tungsten)	Slightly redder	Slightly redder
DYEING: WOOL	1, 2, 3	1, 2
Staining other fibres	Afterchrome: Acetate and Cellulose—*u* Metachrome: Acetate—*u–ss*, Cellulose—*ss*	Both methods: Acetate—*ss*, Cellulose—*u*
DYEING: OTHER FIBRES	Nylon: Afterchrome Silk: Afterchrome, Mordant	Nylon and Silk: Afterchrome and Metachrome
PRINTING		Wool, Silk, Cotton and Nylon: Cr mordant

FASTNESS PROPERTIES ETC.

Method	AATCC	ISO	ISO	ISO
Substrate	Wool (1)	Wool (1)*	Wool (1, 2)	Silk
Alkali	4	4	5	—
Cross Dyeing Wool Acetic/Sulphuric	—	5/5	—	1/2
Carbonising	5	5	5	—
Chlorination	4–5	5	—	—
Decatising	4–5	4–5	5	—
Hot Pressing	5	4–5	4	3–4
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	5–6	5–6	—	4–5
normal	6	6	7	5–6
2× normal	7	7	—	6
Milling: Alkaline	4–5	4–5	4	2
Acid	—	4–5	—	—
Peroxide Bleaching	4	3–4	4–5	2
Perspiration	5	4–5	3	3–4
Potting	4	3–4	3	—
Sea Water	5, 5	5	4–5	—
Stoving	4–5	4–5	4–5	4
Washing	5	5	4–5	—
Water	—	5	5	—

Dischargeability	Not dischargeable	Dischargeable to white
Metal in dyebath: Copper	3 (1), 2 (2), 5 (3)	Greener
Iron	4 (1 and 2), 4–5 (3)	Much duller and redder
Solubility	Very slightly sol. in cold, slightly sol. in hot water	—
NON-TEXTILE USAGE		
REACTIONS	In substance: H_2SO_4 conc.—orange, on diln—yellow	In substance: H_2SO_4 conc.—yellow, on diln—yellow; HNO_3 conc.—golden yellow, on diln—decolorised
NOTES	*Wool (2) and (3) very similar	*Similar to C.I. 18710

32	33	34	C.I. Mordant Yellow
Monoazo **14100**	Aminoketone **56210**		**CHEMICAL CLASS** **C.I. CONSTITUTION NUMBER**
Dull Greenish Yellow Little change	Greenish Yellow Redder	Dull Yellow Greener and duller	**HUE:** Daylight Artificial light (tungsten)
1, 2, 3 Afterchrome: Acetate and Cellulose—*u*	1 Acetate and Silk—*ss*, Cellulose—*u*	1, 2, 3 Afterchrome: Acetate and Cellulose—*u*, Silk—*ss* Metachrome: Acetate—*u*, Cellulose and Silk—*ss* Mordant: Acetate and Cellulose—*u*, Silk—*ss*	**DYEING: WOOL** Staining other fibres
Silk: Afterchrome Cotton: Cr mordant	Nylon: Afterchrome Cotton: Pad with chromium acetate	Nylon: Afterchrome, 90–120 min. boil needed for lake formation Silk: Afterchrome	**DYEING: OTHER FIBRES**
Wool, Silk and Cotton: Cr mordant	Wool, Silk, Cotton and Viscose: Cr mordant Suitable for use in coloured discharges Cotton print fastness: Chlorine 3–4; Light 6, 6–7, 7; Washing 4–5	Wool, Silk and Cotton: Cr mordant	**PRINTING**
ISO Wool (1)* Silk 4 — 3 — — — 5 — 4 — — 3–4 4 — 4–5 5 5 — 4–5 3 2 — 3–4 4 5 5 3 — 5 — 1–2 4 4 4–5 5 5 Dischargeable to white 3–4 2 —	ISO Wool (1) 5 — 5 — 5 4 6 6–7 7 4 2 3 4 2 3–4 4 4–5 4 Not dischargeable Unaltered Redder —	ISO Wool (1, 2, 3) 3–4 3/2 4 5 5 4 4 4–5 5 5 2–3 2–3 5 3–4 5 3–4 5 5 Good 5 4 Suitable package dyeing	**FASTNESS PROPERTIES ETC.** Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
Paper-pulp dyeing Wood stains		Anodised aluminium See Leather Dyes section	**NON-TEXTILE USAGE**
			REACTIONS
*Wool (1) and (2) very similar			**NOTES**

C.I. Mordant Yellow	35	36
CHEMICAL CLASS	Monoazo	Monoazo
C.I. CONSTITUTION NUMBER	**19035**	**14135**
HUE: Daylight	Yellow	Greenish yellow
Artificial light (tungsten)	Duller	Redder
DYEING: WOOL	1, 3	1, 2, 3
Staining other fibres	Afterchrome: Acetate and Cellulose—*u*, Silk—*ss* Mordant: Acetate, Cotton and Silk—*u*, Viscose—*s*	Afterchrome: Acetate and Cellulose—*ss* Metachrome: Acetate —*ss*, Cotton—*hs*, Viscose—*ss–hs*
DYEING: OTHER FIBRES		Silk: Afterchrone, Mordant Nylon: Afterchrome Cotton: Cr mordant
PRINTING	Wool: Cr mordant Vigoureux printing	Wool: Chromium acetate

FASTNESS PROPERTIES ETC.

Method	ISO		AATCC	ISO	ISO
Substrate	Wool (1)	Wool (3)	Wool (1)	Wool (1)*	Silk (1)†
Alkali	4–5	4–5	4–5	5	—
Cross Dyeing Wool Acetic/Sulphuric	–/3	—	—	—	—
Carbonising	4	4	3	2	—
Chlorination	—	—	—	—	—
Decatising	5	4	5	4	—
Hot Pressing	5	5	3–4	5	4–5
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	5	5	—	4	—
normal	5–6	5–6	4–5	4–5	5
2× normal	6	6	—	5	—
Milling: Alkaline	4	4	4	4	3
Acid	—	—	—	2	—
Peroxide Bleaching	2–3	2	4	3	3
Perspiration	5	4	5	4–5	5
Potting	2	2	3	3	—
Sea Water	5	3–4	5	4–5	—
Stoving	5	5	4	2–3	5
Washing	4–5	4–5	4	4	4–5
Water	5	4	4–5	5	5
Dischargeability	Dischargeable to white		Dischargeable to white		
Metal in dyebath: Copper	Redder, duller (1) somewhat redder (3)		Somewhat greener (1) duller (2)		
Iron	Destroyed (1) much duller (3)		Destroyed (brown) (1) duller (2)		
Solubility					

NON-TEXTILE USAGE		Biological stain Leather: On chrome and vegetable tannages
REACTIONS		On wool: 10% H_2SO_4—brown; HNO_3 conc.—reddish brown to orange
NOTES		*Wool (2) very similar †Silk (3) Hot pressing 4, Light 5, Milling 5, Peroxide bleaching 4, Perspiration 5, Stoving 4, Washing and Water 5

37	38	C.I. Mordant Yellow
	Monoazo	CHEMICAL CLASS
	14080	C.I. CONSTITUTION NUMBER
Dull Reddish Yellow Somewhat redder and brighter	Greenish Yellow Redder and duller	HUE: Daylight Artificial light (tungsten)
1 Cotton—*u*, Silk—*ss*	1, 2, 3 Afterchrome: Acetate and Cellulose—*u*, Nylon and Silk—*ss* Metachrome: Acetate and Cellulose—*u*, Silk—*ss*	DYEING: WOOL Staining other fibres
Nylon: Afterchrome, 90 min boil for lake formation		DYEING: OTHER FIBRES
	Wool, Silk and Cotton: Cr mordant	PRINTING

ISO Wool (1)	AATCC Wool (1)	ISO Wool (1)*	FASTNESS PROPERTIES ETC.
4–5	3–4	4–5	Method
–/2	—	1–2/2	Substrate
5	3–4	3–4	Alkali
5	4	3	Cross Dyeing Wool Acetic/Sulphuric
4	5	4–5	Carbonising
			Chlorination
			Decatising
—	4–5	5	Hot Pressing
—	—	4–5	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
5	5–6	5–6	normal
—	—	6	2× normal
4	3–4	5	Milling: Alkaline
3	—	2	Acid
4–5	3	2	Peroxide Bleaching
4	3–4	3–4	Perspiration
5	3–4	3–4	Potting
—	3–4	4	Sea Water
4–5	1–2	3–4	Stoving
4	5	4–5	Washing
4–5	—	4–5	Water
—	Dischargeable to white		Dischargeability
4	Unaffected		Metal in dyebath: Copper
3	Greatly alt. (1 and 2) slightly alt. (3)		Iron
—	—		Solubility

Lakes* Paper: As a pulp colour (the main use of the dye)		NON-TEXTILE USAGE
		REACTIONS
*For producing full reddish yellow lakes by pptg with barium on an alumina-blanc fix base and in conjunction with C.I. Basic Blue 9 and C.I. Basic Green 1 for Myrtle Greens, the basic dye being added at the end of the striking process	*Wool (2) similar	NOTES

C.I. Mordant Yellow	39	40
CHEMICAL CLASS		
C.I. CONSTITUTION NUMBER		
HUE: Daylight	Yellow	Dull Yellow
Artificial light (tungsten)	Redder	Slightly redder
DYEING: WOOL	1, 2, 3	1, 2, 3
Staining other fibres	Acetate, Cellulose and Silk—*u* in all three methods	All three methods: Acetate and Cellulose—*u*, Silk—*ss*
DYEING: OTHER FIBRES		
PRINTING		
FASTNESS PROPERTIES ETC.		
Method	ISO	ISO
Substrate	Wool (1)*	Wool (1)*
Alkali	3–4	4–5
Cross Dyeing Wool Acetic/Sulphuric	—	—
Carbonising	2–3	2
Chlorination	4	—
Decatising	5	5
Hot Pressing	—	4–5
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	—	4
normal	5	4
2× normal	—	4–5
Milling: Alkaline	4–5	4–5
Acid	—	—
Peroxide Bleaching	4–5	—
Perspiration	4–5	4–5
Potting	2–3	3
Sea Water	4–5	5
Stoving	4–5	3
Washing	—	4–5
Water	5	—
Dischargeability	—	—
Metal in dyebath: Copper	—	4 (1) 3(2) 4(3)
Iron	—	1 (1), 2 (2), 3 (4)
Solubility	—	Suitable for package dyeing
NON-TEXTILE USAGE		
REACTIONS		In substance: H_2SO_4 conc.—brownish yellow, on diln—dull yellow ppt. On wool: HNO_3 conc.—lemon spot, orange rim
NOTES	*Wool (2) and (3) similar	*Wool (2) and (3) similar

41	42	43	C.I. Mordant Yellow
	Azo	Azo	CHEMICAL CLASS
			C.I. CONSTITUTION NUMBER
Greenish Yellow Slightly greener	Reddish Yellow Little change	Greenish Yellow Little change	HUE: Daylight Artificial light (tungsten)
2, 3	1	1	DYEING: WOOL
Both methods: Acetate—*u*, Cellulose—*s*	Acetate and Cellulose—*u*, Silk—*hs*	Acetate and Cotton—*u*, Silk—*hs*	Staining other fibres
			DYEING: OTHER FIBRES
			PRINTING
ISO Wool (2)* 5 –/1 4 2–3 5 4 4–5 5 6 5 — 3–4 5 4–5 5 3–4 4–5 4–5 — 4 2–3 —	ISO Wool (1) 5 –/4–5 5 — 4–5 5 6–7 7 7–8 4 3 — 5 4–5 — 5 5 — 5 4 4–5 —	ISO Wool (1) 4 –/3 5 — 5 5 7 8 8 4 3 — 5 3 — 4 4 — 2–3 4 1 —	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
			NON-TEXTILE USAGE
			REACTIONS
*Wool (3) similar but fastness to light lower			NOTES

C.I. Mordant Yellow	44	45	46
CHEMICAL CLASS	Monoazo	Monoazo	Azo
C.I. CONSTITUTION NUMBER	**14115**	**19070**	
HUE: Daylight	Reddish Yellow	Greenish Yellow	Greenish Yellow
Artificial light (tungsten)	Redder and brighter	Duller, slightly redder	Slightly redder
DYEING: WOOL	1	1, 2, 3	1
Staining other fibres	Acetate and Cellulose—*u*, Silk—*ss*	Afterchrome: Acetate and Cellulose—*u–ss*, Silk—*ss*	Acetate and Cotton—*u*, Silk—*ss*
DYEING: OTHER FIBRES			
PRINTING		Wool, Silk and Cotton: Cr mordant Vigoureux printing	
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Wool (1)	Wool (1) / Silk	Wool (1)
Alkali	4–5	5 / —	5
Cross Dyeing Wool Acetic/Sulphuric	—	–/3 / —	1/1–2
Carbonising	4–5	5 / —	5
Chlorination	—	— / —	3–4
Decatising	5	5 / —	5
Hot Pressing	4	4 / 4–5	5
Light: ⅓–½ normal	4–5	5–6 / —	6
normal	5	6 / 4	6–7
2× normal	5	6–7 / —	7
Milling: Alkaline	4	4 / 4	3
Acid	—	— / —	—
Peroxide Bleaching	—	4 / 4	2–3
Perspiration	5	4 / 5	4
Potting	4	2–3 / —	2
Sea Water	5	4 / —	5
Stoving	3–4	4 / 5	4–5
Washing	4–5	4–5 / 5	4
Water	5	4 / 5	4–5
Dischargeability	—	Dischargeable to white	—
Metal in dyebath: Copper	—	Somewhat greener	No change
Iron	—	Much redder	Slight change
Solubility	—	—	—
NON-TEXTILE USAGE	Leather: On chrome tannage, penetration good	Fur for hats, borax clearing 5	
REACTIONS			
NOTES			

47	48	49	C.I. Mordant Yellow
Monoazo	Disazo		CHEMICAL CLASS
14090 (mainly)	**23090**		C.I. CONSTITUTION NUMBER
Dull Brownish Yellow Little change	Dull Reddish Yellow Slightly redder	Greenish Yellow Somewhat redder	HUE: Daylight Artificial light (tungsten)
1, 3 Afterchrome: Acetate and Cellulose—*u*	1, 2 Afterchrome: Acetate and Cellulose—*ss*	1, 2, 3 Afterchrome: Acetate and Cotton—*u*, Silk—*hs*	DYEING: WOOL Staining other fibres
Nylon and Silk: Afterchrome	Silk: Afterchrome, Mordant Cotton: Cr mordant—Fastness: Chlorine 3–4, Light 5–6, Washing 3–4		DYEING: OTHER FIBRES
	Wool and Cotton: Chromium acetate	Wool: Cr mordant Vigoureux printing with chromium fluoride	PRINTING

AATCC	ISO		ISO	FASTNESS PROPERTIES ETC.
Wool (1)	Wool (1)	Silk (1)	Wool (1)	Method
4–5	5	—	4	Substrate
—	—	—	–/2	Alkali
3	3	—	2–3	Cross Dyeing Wool Acetic/Sulphuric
—	—	—	—	Carbonising
5	4–5	—	5	Chlorination
				Decatising
4–5	5	3	3	Hot Pressing
4	4	—	4–5	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
5	4–5	5	5–6	normal
6	5	—	6	2× normal
4–5	4–5	4	4–5	Milling: Alkaline
—	2	—	2	Acid
3–4	3–4	4	—	Peroxide Bleaching
4–5	5	5	4	Perspiration
3	3–4	—	3–4	Potting
5	5	—	—	Sea Water
2	3	4	4	Stoving
4	4–5	5	5	Washing
5	5	5	—	Water
—	—		—	Dischargeability
Unaffected	Little change		4	Metal in dyebath: Copper
Redder and duller	Redder, duller		3	Iron
—	—		—	Solubility
Leather: On chrome and vegetable tannages, good penetration			See Leather Dyes Section	NON-TEXTILE USAGE
				REACTIONS
				NOTES

C.I. Mordant Yellow	50	51	52
CHEMICAL CLASS	Naphthalic acid deriv.	Monoazo	
C.I. CONSTITUTION NUMBER		14075	
HUE: Daylight	Yellow	Greenish Yellow	Dull Greenish Yellow
Artificial light (tungsten)	Little change	Redder and brighter	Redder
DYEING: WOOL		1	
Staining other fibres		Acetate and Cellulose —*u*, Silk—*s*	
DYEING: OTHER FIBRES	Cotton: Pad with chromium acetate		
PRINTING	Wool and Silk: Chromium lactate+ urea+glycerine Cotton: Chromium acetate mordant Suitable for use in coloured discharges		Wool, Silk and Cotton: Cr mordant
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Cotton	Wool (1)	Cotton
Alkali	—	4–5	—
Cross Dyeing Wool Acetic/Sulphuric	—	—	—
Carbonising	—	4–5	—
Chlorination	3–4*	—	4–5*
Decatising	—	5	—
Hot Pressing	—	4	—
Light: ⅓–½ normal	5	—	—
normal	6–7	6	4–5
2× normal	7	—	—
Milling: Alkaline	—	5	—
Acid	—	—	—
Peroxide Bleaching	—	—	—
Perspiration	—	4–5	—
Potting	—	4	—
Sea Water	—	—	—
Stoving	—	—	—
Washing	4	4	5
Water	—	5	
Dischargeability	Not dischargeable	—	2–3
Metal in dyebath: Copper	—	—	—
Iron	—	—	—
Solubility	—	—	—
NON-TEXTILE USAGE			
REACTIONS			
NOTES	*Chlorine		*Chlorine

53	54	55	C.I. Mordant Yellow
	Azo		CHEMICAL CLASS
			C.I. CONSTITUTION NUMBER
Bright Yellow Redder	Yellow Little change	Dull Yellow Little change	HUE: Daylight Artificial light (tungsten)
			DYEING: WOOL Staining other fibres
	Cotton: Pad with chromium acetate	Cotton: Pad with chromium acetate	DYEING: OTHER FIBRES
Wool, Silk and Cotton: Cr mordant	Wool and Silk: Chromium lactate+urea+glycerine Cotton: Chromium acetate mordant	Wool and Silk: Chromium lactate+urea+glycerine Cotton: Chromium acetate mordant	PRINTING
ISO Cotton — — — 4–5* — — — 5–6 — — — — — — — — 5 — 3 — — —	ISO Cotton — — — 5* — — 3–4 4 4–5 — — — — — — — 3–4 — Dischargeable to white — — —	ISO Cotton — — — 5* — — 5 5–6 6 — — — — — — — 5 — Not dischargeable — — —	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
			NON-TEXTILE USAGE
			REACTIONS
*Chlorine	*Chlorine	*Chlorine	NOTES

C.I. Mordant Yellow	56	57	58
CHEMICAL CLASS		Monoazo	
C.I. CONSTITUTION NUMBER		13995	
HUE: Daylight	Dull Yellow→Brownish Olive	Dull Reddish Yellow	Bright Greenish Yellow
Artificial light (tungsten)	Redder	Much redder	
DYEING: WOOL		1, 3	
Staining other fibres			
DYEING: OTHER FIBRES			
PRINTING	Wool, Silk and Cotton: Cr mordant	Cotton: Cr mordant	
FASTNESS PROPERTIES ETC.			
Method	ISO		
Substrate	Cotton		
Alkali	—		
Cross Dyeing Wool Acetic/Sulphuric	—		
Carbonising	—		
Chlorination	—		
Decatising	—		
Hot Pressing	—		
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	—		
normal	2		
2× normal	—		
Milling: Alkaline	—		
Acid	—		
Peroxide Bleaching	—		
Perspiration	—		
Potting	—		
Sea Water	—		
Stoving	—		
Washing	1		
Water	—		
Dischargeability	—		
Metal in dyebath: Copper	—		
Iron	—		
Solubility	—		
NON-TEXTILE USAGE			Anodised aluminium: Fastness—Light 7; Weather, bad; Heat (*a*) 6 h. at 200°C good; (*b*) 1 h. at 250°C good
REACTIONS			
NOTES			

59	60	61	C.I. Mordant Yellow
	Monoazo	Monoazo	CHEMICAL CLASS
	14058		C.I. CONSTITUTION NUMBER
Bright Reddish Yellow	Dull Yellow Slightly redder	Dull Reddish Yellow Slightly redder and brighter	HUE: Daylight Artificial light (tungsten)
	1 Acetate—*u*, Cotton—*ss*, Silk—*hs*	1, 2, 3 Afterchrome: Acetate and Cotton—*ss*, Viscose—*u* Metachrome: Acetate and Cotton—*ss*, Viscose—*u–ss* Mordant: Acetate—*ss*, Cotton—*v–ss*, Viscose—*u*	DYEING: WOOL Staining other fibres
		Silk and Nylon: Afterchrome	DYEING: OTHER FIBRES
		Wool: Cr mordant Nylon: Direct (as an acid dye)	PRINTING
	ISO Wool (1) 4 — 3–4 — 4 4 4–5 5 5–6 4–5 — 3 4–5 3 4–5 3 4 5 — 3–4 2 Good	Wool (2)* ISO Silk Nylon 4–5 — — — — — 5 — — 5 — — 4–5 — — 4 4–5 5 6 4 4–5 6–7 5 4–5 7 5–6 5 4–5 — — — — — 4 2 — 5 4–5 5 4–5 — — 5 — — 4–5 — — 5 3–4 5 5 5 5 — Weaker, greener Duller Soluble in cold and hot water	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
Anodised aluminium: Fastness—Light 7–8, Weather, good; Heat (*a*) 6 h. at 200°C good, (*b*) 1 h. at 250°C good	See Leather Dyes section		NON-TEXTILE USAGE
			REACTIONS
		*Wool (1) and (3) very similar	NOTES

C.I. Mordant Yellow	62	63	64
CHEMICAL CLASS	Azo	Monoazo	Monoazo
C.I. CONSTITUTION NUMBER			
HUE: Daylight	Brownish Yellow	Greenish Yellow	Reddish Yellow
Artificial light (tungsten)	Slightly redder		
DYEING: WOOL	1, 2, 3		
Staining other fibres			
DYEING: OTHER FIBRES	Nylon: Metachrome, solid dyeings obtained on wool–nylon blends		
PRINTING	Vigoureux printing		
FASTNESS PROPERTIES ETC.			
Method	ISO		
Substrate	Wool (2)		
Alkali	3–4		
Cross Dyeing Wool Acetic/Sulphuric	4–5, 5		
Carbonising	—		
Chlorination	4–5*		
Decatising	5		
Hot Pressing	5		
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	5–6		
normal	6		
2× normal	7		
Milling: Alkaline	4–5		
Acid	—		
Peroxide Bleaching	3		
Perspiration	5		
Potting	4–5		
Sea Water	5		
Stoving	4–5		
Washing	—		
Water	—		
Dischargeability	—		
Metal in dyebath: Copper	5		
Iron	5		
Solubility	80g/l		
NON-TEXTILE USAGE		Anodised aluminium: fastness to light 7–8	Anodised aluminium: fastness to light 6
REACTIONS			
NOTES	*Chlorine		

C.I. Mordant Orange	1	2
CHEMICAL CLASS	Monoazo	Monoazo
C.I. CONSTITUTION NUMBER	14030	14040
HUE: Daylight	Dull Yellowish Orange→Brown (Cr) Bright Yellowish—Reddish Orange (Al)	Reddish Orange
Artificial light (tungsten)	Redder	Slightly yellower or redder depend'g on make
DYEING: WOOL	1, 2, 3	1, 2, 3
Staining other fibres	In all three methods Acetate and Viscose—*s*, Cotton—*ss*, Silk—*hs*	Metachrome: Acetate—*s*, Cellulose—*ss*, Silk—*hs*
DYEING: OTHER FIBRES	Nylon: Afterchrome, Metachrome Silk: Afterchrome, Mordant	Nylon: Metachrome Silk: Mordant
PRINTING	Wool: Chromium acetate Silk: Cr mordant Cotton: Cr mordant—fastness Chlorine 4–5, Light 6–7, Washing 2–3 Vigoureux printing	Wool: Chromium acetate, Vigoureux printing Silk: Cr mordant
FASTNESS PROPERTIES ETC.		
Method	AATCC / ISO	ISO / ISO
Substrate	Wool (1) / Wool (1) / Silk	Wool (1, 2 and 3) / Silk*
Alkali	4 / 4 / —	5 / —
Cross Dyeing Wool Acetic/Sulphuric	2/1 / 4/2 / —	1–2/1–2 / 2–3/3–4
Carbonising	2–3 / 2 / —	3 / —
Chlorination	— / 5 / —	4 / —
Decatising	4–5 / 4 / —	4–5 / —
Hot Pressing	dry 2, wet 5 / 2 / 3–4	3 / —
Light: ⅓–½ normal	3 / 3–4 / 3–4	4 / 4
normal	4 / 4 / 4	4–5 / 4–5
2× normal	5 / 5 / 5	5 / 5
Milling: Alkaline	4 / 4 / 3–4	4 / 3
Acid	— / 1–2 / —	3 / —
Peroxide Bleaching	2 / 2 / 1–2	1 / 2
Perspiration	4 / 5 / 3	4–5 / 3–4
Potting	2 / 2–3 / —	3 / —
Sea Water	2–3 / 4–5 / —	5 / —
Stoving	1–2 / 2 / 3	3 / 3
Washing	4 / 4–5 / 4	4 / 4
Water	3–4 / 4–5 / 4–5	4 / 4–5
Dischargeability	Not dischargeable to white	Dischargeable to white
Metal in dyebath: Copper	3 (1) 5 (2) 5 (3)	4 (1, 2 and 3)
Iron	3 (1) 5 (2) 4 (3)	1 (1), 4 (2), 3 (3)
Solubility	Very good	—
NON-TEXTILE USAGE	Anodised aluminium Biological stain and indicator Fast-to-light colours for wallpaper See Leather Dyes section Paper	
REACTIONS	On wool: H_2SO_4 conc.—orange, HCl conc.—red, HNO_3 conc.—yellowish orange	On wool: H_2SO_4 conc.—yellowish red, HCl conc.—orange, HNO_3 conc.—yellowish orange
NOTES		*Using basic chromium chloride mordant

C.I. Mordant Orange	3	4		5	
CHEMICAL CLASS	Monoazo	Monoazo			
C.I. CONSTITUTION NUMBER	**18840**	**18940**			
HUE: Daylight	Dull Reddish Orange	Dull Reddish Orange		Reddish Orange	
Artificial light (tungsten)	Yellower	Yellower		Somewhat purer, yellower	
DYEING: WOOL	1, 2, 3	1, 2, 3		1, 2, 3	
Staining other fibres	Afterchrome: Acetate and Cellulose—*ss*, Silk—*hs*	Afterchrome: Acetate—*ss*, Cotton—*u*, Nylon and Silk—*d*, Viscose—*s* Metachrome: Acetate and Viscose—*ss*, Cotton—*s*, Silk—*hs*		Afterchrome: Acetate and Cotton—*ss*, Silk—*hs*, Viscose—*u* Metachrome: Acetate—*ss*, Cellulose—*u*, Silk—*hs*	
DYEING: OTHER FIBRES	Silk: Afterchrome			Silk: 1, 2, 3 Nylon: Afterchrome	
PRINTING	Wool: Cr mordant Vigoureux printing			Wool and Silk: Cr mordant	
FASTNESS PROPERTIES ETC.					
Method	ISO	AATCC	ISO	AATCC	ISO
Substrate	Wool (1)*	Wool (1)	Wool (1)*	Wool (1)	Wool (1)*
Alkali	5	3	3	—	5
Cross Dyeing Wool Acetic/Sulphuric	–/4	—	—	—	3–4/3–4
Carbonising	4–5	4–5	5	5	5
Chlorination	—	—	—	5	5
Decatising	5	5	5	4–5	5
Hot Pressing	5	4–5	4–5	5	5
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	6–7	—	6	—	6–7
normal	7	6–7	6–7	6	7
2× normal	7–8	—	7	—	7–8
Milling: Alkaline	4	4	4–5	4–5	4–5
Acid	—	—	4	—	4–5
Peroxide Bleaching	3	4	4	—	4
Perspiration	5	4–5	4–5	5	5
Potting	4	4	4	4–5	3–4
Sea Water	5	5	5	5	5
Stoving	4–5	5	5	—	5
Washing	4–5	5	5	—	5
Water	5	—	5	—	5
Dischargeability	—	—		Not dischargeable to white	
Metal in dyebath: Copper	4	Slightly yellower		1	
Iron	1–2	Brown		1	
Solubility	—	—		—	
NON-TEXTILE USAGE		Leather: On Chrome tannage			
REACTIONS					
NOTES	*Wool (2) very similar	*Wool (2) similar but fastness to light only 5, 5–6, 6–7		*Wool (2) and (3) very similar	

6	7	8	C.I. Mordant Orange
Disazo 26520	Azo	Monoazo	CHEMICAL CLASS C.I. CONSTITUTION NUMBER
Dull Reddish Orange (Cr) Bright→Dull Orange (Al) Little change	Dull Reddish Orange Very slightly duller	Reddish orange Brighter and yellower	HUE: Daylight Artificial light (tungsten)
1, 2, 3 Afterchrome: Acetate—*u–ss*, Cellulose—*ss*, Silk—*hs* Metachrome: Acetate and Viscose—*u*—*ss*, Cotton—*s*, Silk—*hs* Mordant: Acetate and Viscose—*ss*, Cotton—*s*, Silk—*hs*	1, 3	1, 2, 3 Afterchrome: Acetate and Silk—*hs*, Cellulose—*u*, Nylon—*s* Metachrome: Acetate—*ss*, Cellulose—*u*, Silk—*hs*	DYEING: WOOL Staining other fibres
Nylon: Afterchrome, 90–120 min boil needed for lake formation Silk: Afterchrome	Silk: Afterchrome	Nylon: Afterchrome	DYEING: OTHER FIBRES
Wool, Silk and Cotton: Cr mordant Cotton print fastness: Chlorine 4; Light 4, 5, 6; Washing 3			PRINTING

AATCC Wool (1)	ISO Wool (1)*	ISO Silk	ISO Wool	AATCC Wool (2)	ISO Wool (1) and (2)	FASTNESS PROPERTIES ETC.
—	5	—	4	4	5	Method
—	4/3	1/2–3	—	4–5/3–4	2/1	Substrate
3	2–3	—	—	5	5	Alkali
—	5	—	—	5	4	Cross Dyeing Wool Acetic/Sulphuric
5	4–5	—	—	4–5	4–5	Carbonising
						Chlorination
						Decatising
3	3	—	—	4	4	Hot Pressing
—	5–6	4	—	6–7	6–7	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
5–6	6	5	5–6	7	7	normal
—	6	5–6	—	7–8	7–8	2× normal
4	4	—	4	4–5	4–5	Milling: Alkaline
—	2	—	—	—	—	Acid
2	2	2–3	—	4–5	4–5	Peroxide Bleaching
5	5	2	—	5	5	Perspiration
—	3	—	—	4	4	Potting
5	5	—	—	5	5	Sea Water
2–3	2–3	4–5	2	4–5	4–5	Stoving
4–5	4–5	4–5	5	5	5	Washing
—	5	4–5	—	5	5	Water
Dischargeable to white			—	—		Dischargeability
Slightly duller			Slightly yellower	Slight change (1); unchanged (2)		Metal in dyebath: Copper
Duller			Slightly yellower	Heavy change (1); unchanged (2)		Iron
Sol. in cold, very sol. hot water			Good	Sol. cold, very sol. hot water		Solubility

See Leather Dyes section	Leather: On chrome tannage		NON-TEXTILE USAGE
On wool: HNO_3 conc.—brownish yellow spot, violet rim			REACTIONS
*Wool (2) and (3) similar			NOTES

C.I. Mordant Orange	9	10	11
CHEMICAL CLASS		Disazo	
C.I. CONSTITUTION NUMBER		26560	
HUE: Daylight		Dull Reddish Orange	Dull Orange (Cr) Clear Yellowish Orange (Al)
Artificial light (tungsten)		Little change	
DYEING: WOOL		1, 2, 3	1
Staining other fibres	This C.I. generic name is discontinued; the dyes formerly listed under it now appear under C.I. Mordant Orange 3	Afterchrome: Acetate and Cellulose—*u*, Silk—*ss*	Acetate, Cellulose, Nylon and Silk—*hs*
DYEING: OTHER FIBRES			
PRINTING		Wool: Chromium acetate or Chromate Silk: Chromate	Vigoureux printing
FASTNESS PROPERTIES ETC.			
Method		ISO	ISO
Substrate		Wool (1)*	Wool
Alkali		3	4
Cross Dyeing Wool Acetic/Sulphuric		3–4/3	–/2
Carbonising		2	2
Chlorination		4–5	—
Decatising		5	5
Hot Pressing		4	2
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal		5	3
normal		5–6	4
2× normal		6	4–5
Milling: Alkaline		3–4	4–5
Acid		2	—
Peroxide Bleaching		2–3	3
Perspiration		4–5	4
Potting		3	3
Sea Water		5	5
Stoving		3	1–2
Washing		4	5
Water		5	5
Dischargeability		Dischargeable to white	Not dischargeable
Metal in dyebath: Copper		2 (1) 5 (2 and 3)	Unchanged
Iron		3–4 (1) 5 (2 and 3)	Browner
Solubility		—	Very good
NON-TEXTILE USAGE		Leather	
REACTIONS			
NOTES		*Wool (2) and (3) similar	

12	13	14	C.I. Mordant Orange
Azo		Anthraquinone 58015	CHEMICAL CLASS C.I. CONSTITUTION NUMBER
Reddish Orange Little change	Reddish Orange Little change	Reddish Orange (Al) } on wool and cotton Reddish Brown (Cr) } Somewhat yellower and brighter	HUE: Daylight Artificial light (tungsten)
1, 2, 3 Metachrome: Acetate and Cellulose—*ss*, Silk—*hs*	1, 2, 3 Afterchrome and Metachrome: Acetate—*ss*, Cellulose—*u*	1, 2, 3 (Al or Cr mordant) Al mordant: Acetate and Cotton—*ss*, Silk and Viscose—*hs* Cr mordant: Acetate and Cellulose—*u*, Silk—*ss*	DYEING: WOOL Staining other fibres
		Silk: Al or Cr mordant Cotton; Al, Cr or Fe mordant;	DYEING: OTHER FIBRES
		Wool, Silk and Cotton: Al or Cr mordant Vigoureux printing Also for dyeing on discharged Al or Cr mordant. Fastness of Al-mordanted cotton: Chlorine 4, Light 6, Washing 4	PRINTING
ISO Wool (1)*	ISO Wool (1)*	ISO Wool (Al mordant) / Wool (Cr mordant)	FASTNESS PROPERTIES ETC.
4–5	—	2 / 4	Method
—	4/4	–/2 / –/2	Substrate
4–5	3–4	3–4 / 1–2	Alkali
5	4–5	— / —	Cross Dyeing Wool Acetic/Sulphuric
4–5	5	4 / 4	Carbonising
			Chlorination
			Decatising
4	3	3–4 / 3–4	Hot Pressing
6	7	5–6 / 5–6	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
6–7	7–8	6 / 6	normal
7	7–8	6–7 / 6–7	2× normal
4–5	5	3–4 / 4	Milling: Alkaline
—	4–5	4 / 4	Acid
4–5	5	3 / 3	Peroxide Bleaching
5	5	4 / 4–5	Perspiration
5	3–4	2–3 / 2	Potting
—	5	5 / 4	Sea Water
5	5	3 / 3	Stoving
4–5	5	4 / 4–5	Washing
5	5	3–4 / 4	Water
Disch'g'ble to white	—	Not dischargeable	Dischargeability
Yellower	1	Slightly duller	Metal in dyebath: Copper
Yellowish brown	1	Duller, much weaker	Iron
Fairly good	—	Soluble in cold water	Solubility
Leather		Intermediate for C.I. 67410 Loose wool, hare and rabbit fur for hats—borax clearing 4	NON-TEXTILE USAGE
			REACTIONS
*Wool (2) and (3) similar	Wool (2) and (3) similar	Fastness on Cr-mordanted Silk: Hot pressing 3; Light 5–6, 5–6, 6; Milling 4; Peroxide bleaching 5; Perspiration 5; Stoving 5; Washing 5; Water 5	NOTES

C.I. Mordant Orange	15	16	17
CHEMICAL CLASS	Monoazo	Pyrazolone disazo	
C.I. CONSTITUTION NUMBER	14035		
HUE: Daylight	Orange	Yellowish Orange	Yellowish→Reddish Orange
Artificial light (tungsten)	Little change	Slightly duller	Yellower
DYEING: WOOL	1, 2, 3	1, 2	1, 2, 3
Staining other fibres	Afterchrome: Acetate and Cotton—*u*	Afterchrome: Acetate—*s*, Cellulose:—*ss*, Silk—*hs*	Afterchrome and Mordant: Acetate, Silk and Viscose—*s*, Cotton—*ss* Metachrome: Acetate and Silk—*s*, Cellulose—*ss*
DYEING: OTHER FIBRES	Silk: Afterchrome, Mordant		
PRINTING	Wool: Chromium acetate or fluoride, or Chromate Vigoureux printing Silk: Chromate		
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Wool (1)	Wool (1)*	Wool (1)*
Alkali	3–4	4	4
Cross Dyeing Wool Acetic/Sulphuric	–/2	4/3	4/3
Carbonising	2	3–4	3–4
Chlorination	—	4	4
Decatising	4	5	5
Hot Pressing	3	4–5	4–5
Light: ⅓–½ normal	4–5	4–5	4–5
normal	5	5	5
2× normal	6	6	6
Milling: Alkaline	4	4	4
Acid	1	2–3	2–3
Peroxide Bleaching	—	3–4	3–4
Perspiration	3–4	4	4
Potting	5	3–4	3–4
Sea Water	—	5	5
Stoving	1	3	3
Washing	3–4	5	5
Water	—	5	5
Dischargeability	Dischargeable to white	—	—
Metal in dyebath: Copper	5	5	5
Iron	4	4	4
Solubility	—	—	—
NON-TEXTILE USAGE			
REACTIONS			
NOTES		*Wool (2) similar but wet fastness usually lower	*Wool (2) similar

18	19	20	C.I. Mordant Orange
Azo	Monoazo 16220		CHEMICAL CLASS C.I. CONSTITUTION NUMBER
Reddish Orange Slightly redder	Reddish Orange Somewhat yellower	Dull Orange Redder	HUE: Daylight Artificial light (tungsten)
1, 2, 3 Afterchrome: Acetate and Cotton—*u*, Silk—*hs*	1		DYEING: WOOL Staining other fibres
Silk: Cr mordant	Silk: Afterchrome Cotton: Cr mordant		DYEING: OTHER FIBRES
Wool: Chromium acetate or fluoride, or Chromate Vigoureux printing Silk: Chromate	Wool, Silk and Cotton: Chromium acetate	Wool, Silk and Cotton: Cr mordant	PRINTING
ISO Wool (1) 3–4 –/2 2 4–5 4 4 4–5 5 6 4 1 — 3–4 5 4 1 3–4 — Dischargeable to white 5 4 —	ISO* Silk (dyed) — — — — — 2–3 — 1–2 — 3 — 3 3 — — 4 4 5 Dischargeable to white — — —	ISO Cotton — — — — — — — 6–7 — — — — — — — — 2–3 — — — — —	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
			NON-TEXTILE USAGE
			REACTIONS
	*Wool print: Light 2, 3, 4; Sea water 3; Washing 4; Water 3–4 Cotton print: Chlorine 3–4; Light 3, 3, 4; Washing 3–4		NOTES

C.I. Mordant Orange	21	22	23
CHEMICAL CLASS		Disazo	
C.I. CONSTITUTION NUMBER		21570	
HUE: Daylight	Bright Reddish Orange	Orange	Dull Orange
Artificial light (tungsten)	Somewhat clearer, yellower	Slightly redder	Little change
DYEING: WOOL	1, 2, 3	1	1, 3
Staining other fibres	Afterchrome: Acetate—*s*, Cellulose—*u*, Nylon—*d*, Silk—*hs* Metachrome: Acetate and Cotton—*ss*, Nylon—*d*, Silk—*hs*, Viscose—*u*		Afterchrome: Acetate and Cellulose—*u*, Silk—*hs*
DYEING: OTHER FIBRES	Nylon: Afterchrome, Metachrome	Silk, Chromium lactate, Mordant Cotton: Pad with chromium acetate	Silk: Afterchrome, Mordant. Nylon: Afterchrome: 90–120 min boil needed for lake formation
PRINTING	Wool: Cr mordant Vigoureux printing	Wool, Silk, Cotton and Viscose: Cr mordant	Wool: Chromium acetate + urea
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO†	ISO
Substrate	Wool (1)*	Cotton print / Silk print	Wool (1)
Alkali	5	— / —	5
Cross Dyeing Wool Acetic/Sulphuric	5/3–4	— / —	–/4
Carbonising	5	— / —	5
Chlorination	—	4* / —	5
Decatising	4	— / —	5
Hot Pressing	redder 3, 5	— / —	—
Light: ⅓–½ normal	6–7	4 / 3–4	6
normal	7	5 / 4	6–7
2× normal	7–8	6 / 4–5	7
Milling: Alkaline	4–5	— / —	4
Acid	3–4	— / —	5
Peroxide Bleaching	4	— / —	4
Perspiration	5	5 / 5	4
Potting	5	— / —	4
Sea Water	5	— / —	—
Stoving	4–5	— / —	4
Washing	4–5	4 / —	4–5
Water	5	5 / 5	5
Dischargeability	Dischargeable to white with dithionite	Dischargeable to white	Dischargeable to white
Metal in dyebath: Copper	Somewhat duller (1), Unaffected (2)	—	1
Iron	Severely affected (1), Somewhat duller (2)	—	1
Solubility	—	—	—
NON-TEXTILE USAGE			
REACTIONS			
NOTES	*Wool (2) very similar	*Chlorine †Printed wool: Washing 4–5 Printed viscose: Light 3–4, 4, 4–5; Perspiration 5; Washing 4; Water 5	

24	25	C.I. Mordant Orange
Monoazo		CHEMICAL CLASS
		C.I. CONSTITUTION NUMBER
Dull Orange Brighter	Dull Reddish Orange→Brown Redder	HUE: Daylight Artificial light (tungsten)
1, 2, 3 Afterchrome: Acetate—*ss*, Cellulose—*u*, Nylon and Silk—*d*		DYEING: WOOL Staining other fibres
Nylon: Afterchrome		DYEING: OTHER FIBRES
	Wool, Silk and Cotton: Cr mordant	PRINTING

AATCC Wool (1)	AATCC Nylon	ISO Cotton	FASTNESS PROPERTIES ETC.
4–5	—	—	Method
2–3/–	—	—	Substrate
3	—	—	Alkali
—	—	4–5■	Cross Dyeing Wool Acetic/Sulphuric
—	5‡	—	Carbonising
			Chlorination
			Decatising
5	5†	—	Hot Pressing
6	—	—	Light: ⅓–½ normal
6	7*	2	normal
7	—	—	2× normal
3–4	4	—	Milling: Alkaline
—	—	—	Acid
1	1	—	Peroxide Bleaching
4	5	—	Perspiration
4–5	—	—	Potting
4	5	—	Sea Water
4–5	—	—	Stoving
4	4–5	5	Washing
—	—	—	Water
(AATCC) Method C, 2–3		Not dischargeable to white	Dischargeability
Much yellower		—	Metal in dyebath: Copper
Much yellower		—	Iron
Very soluble in cold and hot water		—	Solubility

Leather: On chrome tannage		NON-TEXTILE USAGE
In substance: H_2SO_4 conc.— yellower, on diln—dull orange brown. On wool: 10% H_2SO_4—bright greenish yellow, 10% NaOH—yellow		REACTIONS
*Fade–Ometer 4–5 †Wet ‡Sublimation	*Chlorine	NOTES

C.I. Mordant Orange	26	27	28
CHEMICAL CLASS	Monoazo	Azo	Azo
C.I. CONSTITUTION NUMBER	19325		
HUE: Daylight	Orange	Reddish Orange	Dull Reddish Orange
Artificial light (tungsten)	Slightly yellower	Yellower	Little change
DYEING: WOOL	1	1	
Staining other fibres	Acetate and Cellulose—*hs*	Acetate, Cellulose and Silk—*u*	
DYEING: OTHER FIBRES	Silk: Afterchrome	Cotton: Pad with chromium acetate	Cotton: Pad with chromium acetate
PRINTING	Wool: Chromium acetate	Wool: Chromium acetate or lactate mordant Silk: Chromium lactate mordant Cotton: Chromium acetate mordant	Wool and Silk: Chromium lactate + urea + glycerin Cotton: Chromium acetate mordant
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Wool	Wool (1) / Cotton	Cotton
Alkali	—	4 / —	—
Cross Dyeing Wool Acetic/Sulphuric	-/2	4/2 / —	—
Carbonising	4	4–5 / —	—
Chlorination	4	3–4 / 4*	4–5*
Decatising	4	4 / —	—
Hot Pressing	3	4 / —	—
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	5	3 / 4	4–5
normal	5–6	4 / 5	5
2× normal	6	5 / 6	6–7
Milling: Alkaline	4–5	3 / —	—
Acid	—	— / —	—
Peroxide Bleaching	4	3–4 / —	—
Perspiration	5	5 / —	—
Potting	3	5 / —	—
Sea Water	4–5	5 / —	—
Stoving	1–2	4–5 / —	—
Washing	4–5	4–5 / —	3–4 (40°C) 2–3 (100°C)
Water	5	5 / 4–5 (40°C) 3–4 (100°C)	—
Dischargeability	Not dischargeable	Dischargeable to white	Dischargeable to white
Metal in dyebath: Copper	Somewhat redder	Slight change	—
Iron	Much duller	Slight change	—
Solubility	—	—	—
NON-TEXTILE USAGE	Gloving leather		
REACTIONS			
NOTES		*Chlorine	*Chlorine

29	30	C.I. Mordant Orange
Monoazo	Disazo	CHEMICAL CLASS
18744		C.I. CONSTITUTION NUMBER
Unchanged	Dull Orange Yellower	HUE: Daylight Artificial light (tungsten)
1, 2 Afterchrome: Acetate and Viscose—*u*, Silk—*hs*	1, 2, 3	DYEING: WOOL Staining other fibres
Nylon: Afterchrome, Metachrome	Silk: Afterchrome, soap well and sour Nylon: Afterchrome, Metachrome, in both cases with formic acid	DYEING: OTHER FIBRES
	Cotton: Chromium acetate	PRINTING
ISO Wool (1)* 5 — 4–5 4–5 –/2–3 3–4 6 7 7 4–5 4 3–4 4–5 4 5 4 4–5 5 Dischargeable to white Weaker Destroyed —	AATCC Wool (1) 5 — 4 — — 5 — 8 — 4–5 — 1 5 2 4 2 3 — — Unaffected Duller Soluble in cold and very soluble in hot water	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
	Leather: On vegetable or chrome tannage	NON-TEXTILE USAGE
	In substance: H_2SO_4 conc.—violet, on diln—yellow. HCl conc.—reddish blue soln (incomplete). HNO_3 conc.—red soln becoming browner	REACTIONS
*Wool (2) and Silk (1) very similar		NOTES

C.I. Mordant Orange	31	32	33
CHEMICAL CLASS		Azo	Azo
C.I. CONSTITUTION NUMBER			
HUE: Daylight		Reddish Orange	Bright Yellowish Orange
Artificial light (tungsten)		Little change	Little change
DYEING: WOOL		1	
Staining other fibres	This C.I. generic name is discontinued, dyes formerly listed under it now appear under C.I. Mordant Orange 37	Acetate—*ss*, Cotton—*u*, Silk—*hs*	
DYEING: OTHER FIBRES			Silk: Chromium lactate mordant Cotton: Chromium acetate mordant
PRINTING		Wool: Cr mordant Vigoureux printing: CrF_3	Wool and Silk: Chromium lactate + urea + glycerin Cotton: Chromium lactate mordant
FASTNESS PROPERTIES ETC.		ISO	ISO
Method			
Substrate		Wool	Cotton / Silk
Alkali		5	— / —
Cross Dyeing Wool Acetic/Sulphuric		–/4	— / —
Carbonising		4	— / —
Chlorination		—	4–5* / —
Decatising		5	— / —
Hot Pressing		4–5	— / —
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal		6–7	4 / 4
normal		7	5 / 5
2× normal		7–8	5–6 / 6
Milling: Alkaline		4–5	— / 5
Acid		3	— / —
Peroxide Bleaching		—	— / —
Perspiration		5	— / 5
Potting		4–5	— / —
Sea Water		—	— / —
Stoving		4–5	— / —
Washing		5	4–5 / 5
Water		—	— / —
Dischargeability		Not dischargeable to white	Dischargeable to white
Metal in dyebath: Copper		3–4	—
Iron		1	—
Solubility		—	—
NON-TEXTILE USAGE			
REACTIONS			
NOTES			*Chlorine

34	35	36	C.I. Mordant Orange
Pyrazolone	Monoazo	Azo	CHEMICAL CLASS
*	18845		C.I. CONSTITUTION NUMBER
Reddish Orange Slightly yellower	Reddish Orange Yellower and brighter	Bright Orange Little change	HUE: Daylight Artificial light (tungsten)
1, 3 Afterchrome: Acetate—*u*, Cellulose—*ss*	1, 3 Afterchrome: Acetate and Cotton—*u*		DYEING: WOOL Staining other fibres
Silk and Nylon: Afterchrome	Silk: Afterchrome	Silk: Chromium lactate mordant Cotton: Pad with chromium acetate	DYEING: OTHER FIBRES
Wool: Chromium fluoride Silk: Chromium mordant Cotton: Chromium acetate	Wool: Cr mordant Vigoureux printing	Wool and Silk: Chromium lactate + urea + glycerin Cotton: Chromium acetate mordant	PRINTING
AATCC Wool (1) 5 — 4 — 3 5 — 7–8 — 3 — — 5 5 5 5 5 — — Duller Duller Slightly sol. in cold, sol. in hot water	ISO Wool (1) 5 –/4 4–5 — 5 5 5–6 6 6–7 4 — — 5 4 5 4–5 4–5 5 — 4 1–2 —	ISO Cotton / Silk — / — — / — — / — 4–5* / — — / — — / — 5 / 5–6 6 / 6–7 6–7 / 7 — / 4–5 — / — — / — — / 5 — / — — / — — / — 4–5 / 5 — / — Dischargeable to white — — —	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
Casein plastics: Applied as an acid dye. Leather: On chrome and combination tannages			NON-TEXTILE USAGE
In substance: H_2SO_4 conc.—reddish yellow, on diln—no change			REACTIONS
***Preparation** Diazoamidophenol sulphonic acid→ phenyl methyl pyrazolone sulphonic acid		*Chlorine	NOTES

C.I. Mordant Orange	37	38
CHEMICAL CLASS	Monoazo	Azo
C.I. CONSTITUTION NUMBER	**18730**	
HUE: Daylight	Reddish Orange→Dull Yellowish Red	Bright Reddish Orange
Artificial light (tungsten)	Slightly yellower	Little change
DYEING: WOOL	1, 2	
Staining other fibres	Afterchrome: Acetate—*u*—*ss*, Cellulose—*u*, Silk—*hs*	
DYEING: OTHER FIBRES		Cotton: Pad with chromium acetate
PRINTING	Wool: Chromium acetate Vigoureux printing	Wool and Silk: Chromium lactate + urea + glycerin Cotton: Chromium acetate mordant
FASTNESS PROPERTIES ETC.		
Method	ISO	ISO
Substrate	Wool (1)	Cotton
Alkali	5	—
Cross Dyeing Wool Acetic/Sulphuric	2/2	—
Carbonising	3	—
Chlorination	3–4	4–5*
Decatising	4	—
Hot Pressing	3	—
Light: ⅛–½ normal	6	4
normal	6–7	5
2× normal	7	6
Milling: Alkaline	3–4	—
Acid	3	—
Peroxide Bleaching	3	—
Perspiration	5	—
Potting	3	—
Sea Water	4–5	—
Stoving	4	—
Washing	4	4
Water	4–5	—
Dischargeability	Metachrome dyeings dischargeable to white	Dischargeable to white
Metal in dyebath: Copper	2	—
Iron	2	—
Solubility	—	—
NON-TEXTILE USAGE	Loose wool, hare or rabbit fur for hats—borax clearing, 4	
REACTIONS		
NOTES		*Chlorine

39	40	C.I. Mordant Orange
		CHEMICAL CLASS
		C.I. CONSTITUTION NUMBER
Yellowish Orange	Bright Yellowish Orange	HUE: Daylight Artificial light (tungsten)
		DYEING: WOOL Staining other fibres
		DYEING: OTHER FIBRES
		PRINTING
		FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
Anodised aluminium: Fastness: Light 5–6, Weather good, Heat (*a*) 6 h at 200°C weaker, (*b*) 1 h at 250°C weaker	Anodised aluminium: Fastness: Light 6–7, Weather bad, Heat (*a*) 6 h at 200°C good, (*b*) 1 h at 250°C weaker	NON-TEXTILE USAGE
		REACTIONS
		NOTES

C.I. Mordant Orange	41	42	43
CHEMICAL CLASS		Monoazo	Monoazo
C.I. CONSTITUTION NUMBER			
HUE: Daylight	Bright Orange	Reddish Orange	Dull Orange
Artificial light (tungsten)		Slightly yellower	Brighter
DYEING: WOOL		2	1, 2
Staining other fibres		Acetate and Cotton—*ss*	
DYEING: OTHER FIBRES		Silk: Metachrome	
PRINTING			
FASTNESS PROPERTIES ETC.			
Method		ISO	ISO
Substrate		Wool	Wool (1)
Alkali		4	4–5
Cross Dyeing Wool Acetic/Sulphuric		–/4	4–5/3
Carbonising		5	5
Chlorination		—	4
Decatising		5	5
Hot Pressing		dry 4	5
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal		5	6
normal		6	6–7
2× normal		7	7
Milling: Alkaline		4	4–5
Acid		—	3
Peroxide Bleaching		4	3–4
Perspiration		4–5	5
Potting		3	4–5
Sea Water		5	5
Stoving		5	4–5
Washing		4–5	4–5
Water		5	5
Dischargeability		—	—
Metal in dyebath: Copper		Yellower	Greener
Iron		Duller	Destroyed
Solubility		—	Soluble in cold and hot water
NON-TEXTILE USAGE	Anodised aluminium: Fastness—Light 6–7; Weather, fairly good to good; Heat (*a*) 6 h at 200°C good; (*b*) 1 h at 250°C good		
REACTIONS		In substance: H_2SO_4 conc.—yellow, on diln—reddish yellow	
NOTES			

44	45	46	C.I. Mordant Orange
			CHEMICAL CLASS
			C.I. CONSTITUTION NUMBER
	Orange	Dull Reddish Orange	**HUE:** Daylight Artificial light (tungsten)
			DYEING: WOOL Staining other fibres
			DYEING: OTHER FIBRES
			PRINTING
ISO — 3–4 4/– 2–3 3–4 5 3, 5 — 5–6 6 3–4 2–3 — 4–5 4 4–5 1–2 3–4 — — 4 5 —			**FASTNESS PROPERTIES ETC.** Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
See Leather Dyes section	Anodised aluminium: Fastness—Light 7	Anodised aluminium: Fastness —Light 4 (pale dyeings)	**NON-TEXTILE USAGE**
			REACTIONS
			NOTES

C.I. Mordant Orange	47	48
CHEMICAL CLASS		Monoazo
C.I. CONSTITUTION NUMBER		
HUE: Daylight	Reddish Orange	Dull Orange
Artificial light (tungsten)	Redder, brighter	Yellower, brighter
DYEING: WOOL	1, 2	1
Staining other fibres	—	Acetate and Cellulose—*ss*, Nylon dyed redder than wool, Polyester—*u*, Silk, dyed paler than wool
DYEING: OTHER FIBRES	Silk Nylon: Afterchrome	
PRINTING	Vigoureux printing	
FASTNESS PROPERTIES ETC.		
Method	ISO	ISO
Substrate	Wool (1) / Nylon	Wool
Alkali	5 / 5	4
Cross Dyeing Wool Acetic/Sulphuric	— / —	4–5/4
Carbonising	5 / —	4–5
Chlorination	4 / 4–5	4–5
Decatising	— / —	4
Hot Pressing	— / —	4–5
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	5–6 / 5	6
normal	6 / 5–6	6–7
2× normal	6–7 / 6	7
Milling: Alkaline	5 / 5	4
Acid	— / —	5
Peroxide Bleaching	3 / 5	4
Perspiration	5 / 5	5
Potting	4–5 / 4	4
Sea Water	5 / 5	5
Stoving	5 / —	4–5
Washing	5 / 5	5
Water	5 / 5	5
Dischargeability	4–5 wool, 4 nylon	4
Metal in dyebath: Copper	—	3 yellower
Iron	—	2 yellower, duller
Solubility	32g/l	Suitable for package dyeing
NON-TEXTILE USAGE	Leather: On chrome and vegetable tannages	
REACTIONS		
NOTES		

C.I. Mordant Red	1	2	3
CHEMICAL CLASS	Azo	Anthraquinone	Anthraquinone
C.I. CONSTITUTION NUMBER		58260	58005
HUE: Daylight	—	Dull Red	Bright Yellowish Red (Al) Dull Bluish Red (Cr)
Artificial light (tungsten)	Little yellower	Yellower	—
DYEING: WOOL	1, 2, 3	3	Al or Cr aftertreatment Al, Cr or Sn mordant
Staining other fibres	Metachrome: Cellulose—*ss*, Silk—*s*, Nylon: dyed much bluer than wool Afterchrome: Silk—*s*, Nylon: dyed much bluer than wool Mordant: Silk—*s*	Acetate—*u*, Cellulose—*ss*, Silk—*hs*	Afterchrome: Acetate—*ss*, Cellulose—*u–ss* Al mordant: Acetate and Cellulose—*u*, Silk—*hs*
DYEING: OTHER FIBRES	Silk: Afterchrome, Mordant		Silk and Nylon: Afterchrome
PRINTING		Cotton: Al or Cr mordant	Wool: Al or Cr mordant Silk: Cr mordant Vigoureux printing
FASTNESS PROPERTIES ETC.			
Method	ISO	AATCC	AATCC / ISO
Substrate	Wool (2)	Wool	Wool (1) / Wool (1)* / Silk
Alkali	4–5	3	3–4 / 4 / —
Cross Dyeing Wool Acetic/Sulphuric	—	—	4/1 / 4/4 / 1–2/2
Carbonising	4–5	4	2–3 / 1 / —
Chlorination	5	—	— / 5 / —
Decatising	5	—	3 / 5 / —
Hot Pressing	5	dry 2, wet 5	3–4 / 3 / 3–4
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	5–6	—	5 / 5–6 / 4–5
normal	6–7	7	6–7 / 6 / 5–6
2× normal	7	—	7 / 6–7 / 6
Milling: Alkaline	3–4	3	3 / 4–5 / 2–3
Acid	—	—	— / 1 / —
Peroxide Bleaching	2	3	2 / 3 / 3–4
Perspiration	5	4	5 / 4–5 / 3
Potting	3–4	4–5	3 / 4 / —
Sea Water	5	5	5 / 4 / —
Stoving	4–5	2	4–5 / 4 / 3
Washing	3–4	4	4 / 5 / 3
Water	—	5	4 / 5 / 4
Dischargeability	Dischargeable to white	—	Poor
Metal in dyebath: Copper	—	Unaffected	Bluer
Iron	—	Bluer and duller	Duller
Solubility	Suitable for package dyeing	—	Suitable for package dyeing
NON-TEXTILE USAGE		Calcium aluminium salts used as pigments because of their very good fastness to light	Drugs and cosmetics Indicator pH 3·7–5·2 yellow to violet Lakes. Microscopic stain
REACTIONS			
NOTES			*Wool (3) similar

C.I. Mordant Red	4	5		6
CHEMICAL CLASS	Anthraquinone	Monoazo		Monoazo
C.I. CONSTITUTION NUMBER	**58240**	**14290**		
HUE: Daylight	Dull Red	Dull Red→Bordeaux		Bluish Red
Artificial light (tungsten)	Yellower	Yellower		Yellower, brighter
DYEING: WOOL	3	1, 2, 3		1, 3
Staining other fibres	Acetate—*u*, Cellulose—*ss*, Silk—*hs*	Afterchrome: Acetate and Cellulose—*u–ss*, Nylon—*d*, Silk—*hs* Mordant: Acetate—*ss*, Cotton—*u–ss*		Afterchrome: Acetate, Nylon and Silk—*hs*, Cellulose—*u*
DYEING: OTHER FIBRES	Silk: Sn or Al mordant			
PRINTING	Cotton: Al or Cr mordant	Wool and Silk: Cr mordant Vigoureux printing		
FASTNESS PROPERTIES ETC.				
Method	AATCC	AATCC	ISO	AATCC
Substrate	Wool (3)	Wool (1)	Wool (1)	Wool (1)
Alkali	3	4	3–4	4
Cross Dyeing Wool Acetic/Sulphuric	—	4/3	4/4	–/2
Carbonising	4	4	4–5	3
Chlorination	—	—	5	—
Decatising	—	4	5	5
Hot Pressing	dry 2, wet 5	4–5	2–3	2
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	—	4	4–5	4
normal	7	5	5	5
2× normal	—	6	6	6
Milling: Alkaline	2	4–5	3–4	4–5
Acid	—	—	3	—
Peroxide Bleaching	2	1–2	2–3	4
Perspiration	5	4–5	4	5
Potting	4	3–4	3–4	4
Sea Water	5	5	4–5	5
Stoving	2	4–5	4–5	4
Washing	4	4–5	4	4–5
Water	—	5	5	5
Dischargeability	—	Dischargeable to white		—
Metal in dyebath: Copper	Unaffected	Slightly yellower		—
Iron	Bluer and duller	Destroyed		—
Solubility	Insoluble in water	Excellent		Soluble in cold and hot water
NON-TEXTILE USAGE	Calcium aluminium salts used as pigments because of their very good fastness to light	Anodised aluminium Loose fur for hats—borax clearing 5		
REACTIONS		On wool: HNO_3 conc.—dull orange		On wool: H_2SO_4 conc.—brown; HNO_3 conc.—brown
NOTES				

7	8	9	
Monoazo **18760**	Disazo **23095**	Monoazo **16105**	**CHEMICAL CLASS** **C.I. CONSTITUTION NUMBER**
Bluish Red Slightly redder	Dull Yellowish Red Redder	Bluish Red Yellower	**HUE:** Daylight Artificial light (tungsten)
1, 2, 3 Afterchrome: Acetate—*ss–hs*, Cotton—*u–ss*, Viscose—*u–hs*	1, 2, 3* Afterchrome: Acetate and Cellulose—*hs*, Nylon and Silk—*d*	1, 2, 3 Afterchrome and Metachrome: Acetate—*u*, Cellulose—*u–ss*, Silk—*ss–hs* Afterchrome: Nylon—*hs*	**DYEING: WOOL** Staining other fibres
Silk: Afterchrome, Mordant Nylon: Afterchrome, 90–120 min boil needed for lake formation	Silk: Neutral or acetic acid		**DYEING: OTHER FIBRES**
Wool and Silk: Cr mordant Vigoureux printing	Wool and Silk: Direct as an acid dye	Wool: Cr mordant	**PRINTING**

AATCC Wool (1)	ISO Wool (1)	AATCC Wool (1)	AATCC Wool (1)	ISO Wool (1)	**FASTNESS PROPERTIES ETC.**
4	4–5	4–5	4	4	Method
4/4	4/4	—	4/2	4/4	Substrate
5	4	4	4–5	4	Alkali
—	5	—	—	5	Cross Dyeing Wool Acetic/Sulphuric
5	5	—	5	5	Carbonising
					Chlorination
					Decatising
4–5	3	dry 5, wet 4–5	dry 2, wet 5	3	Hot Pressing
5	4–5	3	5	6	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
5	5	4	6	6–7	normal
6	6	5	7	7	2× normal
4	4–5	3–4	3–4	3–4	Milling: Alkaline
—	4–5	—	—	3–4	Acid
4–5	3–4	1	2	2	Peroxide Bleaching
4	5	4–5	4	5	Perspiration
4	4–5	3–4	3–4	4–5	Potting
5	5	4	4–5	5	Sea Water
4	5	4	4–5	5	Stoving
5	5	3–4	5	4–5	Washing
5	5	—	5	5	Water
Poor		—	Dischargeable to white		Dischargeability
Much altered		—	2		Metal in dyebath: Copper
Destroyed		—	4		Iron
Good		—	—		Solubility
Anodised aluminium See Leather Dyes section Loose wool and fur for hats—borax clearing 5	Leather	See Leather Dyes section See C.I. Pigment Red 60			**NON-TEXTILE USAGE**
		On wool: HNO_3 conc.—little change but white rim			**REACTIONS**
	*Also as an acid dye from neutral or acetic acid bath				**NOTES**

C.I. Mordant Red	10	11
CHEMICAL CLASS	Monoazo	Anthraquinone
C.I. CONSTITUTION NUMBER		58000
HUE: Daylight	Dull Red	Dull Bluish Red (Cr) Red—Bluish Red (Al)
Artificial light (tungsten)	Yellower, brighter	Yellower
DYEING: WOOL	1, 2, 3	Al or Cr mordant
Staining other fibres	Afterchrome: Acetate—*ss*, Cellulose—*u*, Nylon and Silk—*d*	Al mordant: Acetate and Silk—*ss–hs*, Cellulose—*ss* Cr mordant: Acetate—*u*, Cellulose—*ss*, Silk—*hs*
DYEING: OTHER FIBRES		Silk: Al, Cr or Sn mordant Cotton: Al, Cr or Fe mordant
PRINTING		Cotton: Al, Cr, Al-oil or Fe mordant

FASTNESS PROPERTIES ETC.

Method	AATCC	AATCC	ISO	ISO
Substrate	Wool (1)	Wool	Al mordant	Silk Al mordant
Alkali	1	3	3	—
Cross Dyeing Wool Acetic/Sulphuric	–/1	3/1	2/1	–/2
Carbonising	3	4	1	—
Chlorination	—	—	1	—
Decatising	—	5	3	—
Hot Pressing	dry 5, wet 4–5	dry 2, wet 5	3–4	3
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	4	6	6–7	6
normal	5	7	7	6
2× normal	6	7–8	7–8	6–7
Milling: Alkaline	4	2–3	3–4	3
Acid	—	—	1	—
Peroxide Bleaching	1	4	3	4–5
Perspiration	4–5	4	3	4
Potting	4	4–5	2–3	5
Sea Water	4	4–5	4	—
Stoving	4	2	2	—
Washing	4	4	4	5
Water	—	5	4	5
Dischargeability	—	Not dischargeable		
Metal in dyebath: Copper	Much yellower	Duller		
Iron	Much yellower and duller	Bluer and duller		
Solubility	Soluble in cold and very soluble in hot water	—		

NON-TEXTILE USAGE	Leather: On chrome tannage	Biological stain Indicator See C.I. Pigment Red 83
REACTIONS	In substance: H_2SO_4 conc.—dull orange brown, on diln—weak dull yellow	
NOTES		Fastness on cotton is very dependent on method of application

12	13	14	C.I. Mordant Red
Azo	Monoazo *	Monoazo	CHEMICAL CLASS C.I. CONSTITUTION NUMBER
Yellowish Red Yellower	Dull Bluish Red Much redder and brighter	Dull Red Slightly yellower	HUE: Daylight Artificial light (tungsten)
1, 3 Afterchrome: Acetate—*s*, Cotton—*u*, Silk—*hs*	1, 2, 3 Afterchrome: Acetate, Cellulose and Silk—*hs*	2 Acetate and Cellulose—*ss*, Silk—*hs*	DYEING: WOOL Staining other fibres
	Nylon and Silk: Metachrome		DYEING: OTHER FIBRES
			PRINTING
ISO Wool (1) 5 –/4 5 — 5 4–5 6 6–7 7 4 3 — 5 4–5 — 4–5 4 — 2–3 3–4 1 —	ISO Wool (1)† 4 2/2 4 3–4 4–5 4 4 5 5–6 4 3–4 3 3–4 2 4–5 4 4 4–5 Good 2–3 1 —	ISO Wool 4 –/3 3 5 5 4 6 7 7 5 — 4 5 3–4 5 4–5 5 5 Not dischargeable Trace yellower Trace yellower, slightly duller —	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
		See Leather Dyes section	NON-TEXTILE USAGE
			REACTIONS
	*Preparation: A nuclear-substituted *o*-amino-phenol→a subst. phenol †Wool (2) and (3) very similar		NOTES

C.I. Mordant Red	15	16	17	
CHEMICAL CLASS	Xanthene		Monoazo	
C.I. CONSTITUTION NUMBER	45305		18750	
HUE: Daylight	Bluish Red	Dull Bluish Red	Dull Yellowish Red	
Artificial light (tungsten)	Slightly yellower		Brighter and redder	
DYEING: WOOL	1, 2	1, 2, 3	1, 2, 3	
Staining other fibres	Afterchrome: Acetate, Cellulose and Silk—*hs* Metachrome: Acetate and Cellulose—*s*, Silk—*hs*	Afterchrome and Mordant: Acetate and Cellulose—*u*, Silk—*hs* Metachrome: Acetate—*u*, Cellulose—*ss*, Silk—*hs*	Afterchrome: Acetate and Cotton—*u–ss*, Silk—*ss–hs*, Viscose—*u* Metachrome: Acetate and Cellulose—*u*, Silk—*s* Mordant: Acetate and Cellulose—*u*, Silk—*hs*	
DYEING: OTHER FIBRES	Silk: Afterchrome		Silk: Afterchrome Nylon: Afterchrome, 90–120 min boil needed for lake formation	
PRINTING	Wool, Silk and Cotton: Cr mordant		Wool: Cr mordant Vigoureux printing	
FASTNESS PROPERTIES ETC.				
Method	ISO	ISO	AATCC	ISO
Substrate	Wool (1)	Wool (1)*	Wool (1)	Wool (1)*
Alkali	3–4	5	—	4–5
Cross Dyeing Wool Acetic/Sulphuric	–/2	—	—	4/3–4
Carbonising	3–4	3	5	4–5
Chlorination	—	—	4–5	4–5
Decatising	4–5	5	5	5
Hot Pressing	3	5	5	3
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	4	3	—	5–6
normal	4	4	6	6–7
2× normal	4–5	4–5	—	7
Milling: Alkaline	3–4	5	3–4	4–5
Acid	—	—	—	4
Peroxide Bleaching	3	—	—	4–5
Perspiration	5	4	4–5	5
Potting	2–3	2	3–4	4
Sea Water	5	5	5	5
Stoving	4	3	—	4
Washing	3–4	5	—	4–5
Water	4–5	—	—	5
Dischargeability	Not dischargeable	—	Not dischargeable	
Metal in dyebath: Copper	Weaker and (metachrome) bluer	2–3	2	
Iron	Somewhat yellower	1	1	
Solubility	—	—	—	
NON-TEXTILE USAGE			Anodised aluminium Leather	
REACTIONS			On wool: HNO_3 conc.—reddish orange	
NOTES		*Wool (2) and (3) similar	*Wool (2) and (3) similar	

18	19	C.I. Mordant Red
Monoazo *	Monoazo 18735	CHEMICAL CLASS C.I. CONSTITUTION NUMBER
	Bright Red Yellower	HUE: Daylight Artificial light (tungsten)
1, 2, 3 Afterchrome: Acetate—*ss*, Cellulose—*u*, Silk—*hs*	1, 2, 3 Afterchrome: Acetate—*ss–hs*, Cellulose—*u–ss*, Nylon and Silk—*hs* Metachrome: Acetate and Silk—*ss–hs*, Cellulose—*u–ss*, Nylon—*hs* Mordant: Acetate and Silk—*hs*, Viscose—*u–ss*	DYEING: WOOL Staining other fibres
Silk and Nylon: Afterchrome	Nylon: Afterchrome Silk: Mordant	DYEING: OTHER FIBRES
	Wool: Cr mordant Vigoureux printing	PRINTING

ISO Wool (1)†	AATCC Wool (1)	AATCC Wool (2)	ISO Wool (1)	ISO Wool (2)	Silk	FASTNESS PROPERTIES ETC.
4	—	4	—	—	—	Method
–/2–3	—	—	4/4	4/2	3–4/2	Substrate
4–5	4	4	4	4–5	—	Alkali
—	4–5	—	5	5	—	Cross Dyeing Wool Acetic/Sulphuric
4–5	5	5	5	5	—	Carbonising
						Chlorination
3	5	4–5	3	3	4(A), 5(B)	Decatising
5–6	—	—	5–6	5–6	5	Hot Pressing
6	6	6–7	6	6	5–6	Light: ⅓–½ normal
7	—	—	6–7	6–7	6	normal
5	5	4–5	4	4–5	4	2× normal
—	—	—	4–5	4–5	—	Milling: Alkaline
3	—	2–3	3–4	4	2	Acid
5	5	4–5	4–5	5	3–4	Peroxide Bleaching
3	4–5	3–4	3	3–4	—	Perspiration
						Potting
5	5	5	4–5	4–5	—	Sea Water
4	—	4	4–5	4–5	4	Stoving
5	—	4	4–5	4–5	4–5	Washing
5	—	5	5	5	4	Water
—	Not dischargeable					Dischargeability
5 (1), 4–5 (2)	1					Metal in dyebath: Copper
1 (1), 4 (2)	1					Iron
—	Soluble in cold and hot water					Solubility

	See Leather Dyes section
	On wool: HNO_3 conc.—brown
*Similar to C.I. 18750 †Wool (2) similar	

NON-TEXTILE USAGE

REACTIONS

NOTES

C.I. Mordant Red	20	21
CHEMICAL CLASS		Monoazo
C.I. CONSTITUTION NUMBER		17995
HUE: Daylight	Dull Bluish Red	Bright Bluish Red
Artificial light (tungsten)	Slightly yellower and brighter	Slightly yellower
DYEING: WOOL	1, 3	1, 2, 3
Staining other fibres	Afterchrome: Acetate, Cotton and Silk—*ss*, Viscose—*u*	Afterchrome: Acetate and Viscose—*u*, Cotton—*u–vss*, Silk—*hs* Metachrome: Acetate—*u*, Cellulose—*ss*, Silk—*hs*
DYEING: OTHER FIBRES		
PRINTING	Wool: Chromium acetate+10% urea for long steaming+in addition for short steaming ammonium sulphocyanide	Wool: Cr mordant Vigoureux printing
FASTNESS PROPERTIES ETC.		
Method	ISO	AATCC / ISO
Substrate	Wool (1)	Wool (1) / Wool (1) / Wool (2)
Alkali	4	— / 4 / 4
Cross Dyeing Wool Acetic/Sulphuric	–/4–5	— / –/4–5 / —
Carbonising	5	3 / 4–5 / 4–5
Chlorination	4–5	5 / — / —
Decatising	4–5	5 / 5 / 5
Hot Pressing	3–4	5 / 4 / 4
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	4	— / 4 / 4
normal	4–5	4–5 / 4–5 / 4–5
2× normal	6	— / 5 / 5
Milling: Alkaline	4–5	3 / 4 / 4
Acid	4	— / 4 / 4
Peroxide Bleaching	2	— / 3–4 / 3
Perspiration	4	4 / 3 / 4–5
Potting	4	3 / 2 / 1–2
Sea Water	5	5 / 4–5 / 3
Stoving	5	3–4 / 4 / 4
Washing	5	4 / 3 / 3
Water	5	— / 4–5 / 4–5
Dischargeability	Not dischargeable	Dischargeable to white
Metal in dyebath: Copper	1	bluer, duller (1) weaker (2)
Iron	1	destroyed (1) weaker (2)
Solubility	Very good	—
NON-TEXTILE USAGE		Fur for hats, borax clearing 3
REACTIONS		
NOTES		

22	23	24	C.I. Mordant Red
	Azo	Azo	CHEMICAL CLASS
			C.I. CONSTITUTION NUMBER
Bright Red Slightly yellower	Red Unchanged	Yellowish Red Somewhat yellower	HUE: Daylight Artificial light (tungsten)
Aluminium mordant Acetate and Silk—*ss–hs*, Cotton—*ss*, Viscose—*u–ss*	1, 2, 3 Metachrome: Acetate and Cellulose —*ss*, Silk—*hs*	1, 3 Afterchrome: Acetate —*vss* Cotton—*u*, Silk—*hs*	DYEING: WOOL Staining other fibres
Silk and Cotton: Al or Cr mordant			DYEING: OTHER FIBRES
Cotton: Al-oil, Cr or Fe mordant		Wool: Chromium acetate or chromate	PRINTING
ISO Wool / Silk (Cr)	ISO Wool (2)*	ISO Wool (1)	FASTNESS PROPERTIES ETC.
1–2 / —	4	5	Method
–/1–2 / –/2	–/5–4	–/4	Substrate
2 / —	4–5	—	Alkali
— / —	4	4	Cross Dyeing Wool Acetic/Sulphuric
3 / —	4–5	5	Carbonising
			Chlorination
			Decatising
2–3 / 3–4	1	4–5	Hot Pressing
6–7 / 6	6–7	5–6	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
7 / 6	6–7	6	normal
7 / 6–7	7	6–7	2× normal
4 / 3–4	5	4–5	Milling: Alkaline
— / —	—	3	Acid
4 / 3–4	3	—	Peroxide Bleaching
4 / 4	5	5	Perspiration
2–3 / 5	3	4	Potting
4–5 / —	3	—	Sea Water
3 / —	5	4	Stoving
4–5 / 5	4–5	4–5	Washing
5 / 5	5	—	Water
Not dischargeable	Dischargeable to white	2–3	Dischargeability
Unaffected	Duller (2), very much yellower (1)	4–5	Metal in dyebath: Copper
Bluer and much duller	Weaker (2), yellowish brown (1)	1	Iron
—	Suitable for package dyeing	—	Solubility
Lake making	See Leather Dyes section		NON-TEXTILE USAGE
			REACTIONS
Fastness properties on cotton vary greatly according to conditions of application	*Wool (1) and (3) similar		NOTES

C.I. Mordant Red	25	26	27
CHEMICAL CLASS	Monoazo	Monoazo	Xanthene
C.I. CONSTITUTION NUMBER		17075	45180
HUE: Daylight	Bordeaux	Bright Bluish Red	Bluish Pink
Artificial light (tungsten)	Much yellower and brighter	Little change	Yellower and brighter
DYEING: WOOL	1, 2	1	1, 2, 3
Staining other fibres	Afterchrome: Acetate—*ss*, Cellulose—*u*, Silk—*hs* Metachrome: Acetate and Cellulose—*ss*, Silk—*hs*	Acetate and Cellulose—*u–ss*	Acetate and Cellulose—*ss*
DYEING: OTHER FIBRES		Silk: Afterchrome	Silk: Afterchrome, Metachrome
PRINTING	Wool and Silk: Sulphocyanide method with chromium acetate	Wool, Silk and Cotton: Cr mordant. Vigoureux printing. Fastness, cotton print: Chlorine 2; Light 2, 3, 4; Washing 3–4	Wool: Chromium acetate Vigoureux printing
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Wool (1)	Wool / Silk	Wool (1)* / Silk†
Alkali	5	5 / —	4 / —
Cross Dyeing Wool Acetic/Sulphuric	—	4–5/3 / 1/2	— / 4/4–5
Carbonising	4–5	4 / —	4 / —
Chlorination	4	4 / —	— / —
Decatising	4–5	5 / —	4–5 / —
Hot Pressing	4	4 / 3–4	4–5 / 4
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	6	6 / 5	4–5 / 4–5
normal	6–7	6 / 6	5 / 5
2× normal	7	6–7 / 7	5–6 / 5–6
Milling: Alkaline	4–5	5 / 2	4 / 3
Acid	4–5	4 / —	— / —
Peroxide Bleaching	3–4	3 / 3	2 / —
Perspiration	4–5	4–5 / 2–3	4 / 4–5
Potting	3–4	4 / —	3 / —
Sea Water	4–5	5 / 4–5	4–5 / —
Stoving	4–5	4–5 / —	4–5 / 4
Washing	5	5 / 2–3	4 / 4
Water	5	5 / 3	5 / 4–5
Dischargeability	Dischargeable to white	Dischargeable to white	Suitable for coloured discharges
Metal in dyebath: Copper	5 (1), 2–3 (2)	Little change	Slightly yellower
Iron	1 (1), 4–5 (2)	3–4 bluer and duller	Much yellower, duller
Solubility	—	—	—
NON-TEXTILE USAGE		Fur for hats—borax clearing 5	
REACTIONS			
NOTES			*Wool (2) very similar †Afterchrome

28	29	30	C.I. Mordant Red
Monoazo	Triphenylmethane	Monoazo	CHEMICAL CLASS
11170	43505	19360	C.I. CONSTITUTION NUMBER
Bordeaux Redder		Dull Bluish Red Unchanged	HUE: Daylight Artificial light (tungsten)
1, 2, 3	3	1, 2 Afterchrome: Acetate—*ss*, Cellulose—*u*, Silk—*hs* Metachrome: Acetate and Cotton—*s*, Silk—*hs*, Viscose—*u*	DYEING: WOOL Staining other fibres
			DYEING: OTHER FIBRES
	Cotton: Cr mordant	Wool: Chromium acetate	PRINTING
ISO Wool (2) 3 — 3 — 3 3–4 — 3–4 — 4–5 — 1–2 4–5 4 4–5 3 5 4–5 Dischargeable — — —		ISO Wool (1) Wool (2) 4–5 4 — –/2 4 4–5 — — 4–5 4–5 4 4 6 6 6–7 6–7 7 7 5 4–5 3 3 3–4 4 4–5 4–5 3–4 3–4 5 4–5 4 4–5 5 4 5 4–5 Dischargeable to white 2 (1) Brighter and bluer 4 (2) 1 (1) Strongly altered 1–2 (2) Suitable for package dyeing	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
			NON-TEXTILE USAGE
On wool: H_2SO_4 conc.—orange brown; HNO_3 conc.—olive brown			REACTIONS
			NOTES

C.I. Mordant Red	31	32	33	
CHEMICAL CLASS		Monoazo	Monoazo	
C.I. CONSTITUTION NUMBER		14210		
HUE: Daylight	Bordeaux	Dull Bordeaux	Dull Bluish Red	
Artificial light (tungsten)	Somewhat yellower	Browner		
DYEING: WOOL	—	1, 2	1	
Staining other fibres			Acetate and Cellulose—*u* Silk—*ss*	
DYEING: OTHER FIBRES				
PRINTING	Wool, Silk and Cotton: Cr mordant		Wool: Chromium acetate	
FASTNESS PROPERTIES ETC.				
Method	ISO	ISO	AATCC	ISO
Substrate	Cotton	Wool (1) and (2)	Wool (1)	Wool (1)
Alkali	—	5	—	4
Cross Dyeing Wool Acetic/Sulphuric	—	—	—	–/4
Carbonising	—	5	4	4
Chlorination	3–4*	—	—	4–5
Decatising	—	5	—	4–5
Hot Pressing	—	4	5	—
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	—	—	—	6
normal	3	7	5–6	6–7
2× normal	4	—	—	7
Milling: Alkaline	—	3	4–5	3
Acid	—	—	—	4
Peroxide Bleaching	—	—	—	5
Perspiration	—	4	4	4
Potting	—	2	3	5
Sea Water	—	—	4	4
Stoving	—	4	—	4
Washing	4–5	—	4–5	5
Water	—	4	—	5
Dischargeability	Good		Unsuitable	
Metal in dyebath: Copper	—		1–2	
Iron	—		1	
Solubility	—		Very good	
NON-TEXTILE USAGE				
REACTIONS				
NOTES	*Chlorine			

34	35	36	C.I. Mordant Red
Monoazo **16060**		Monoazo	CHEMICAL CLASS C.I. CONSTITUTION NUMBER
Bluish Red Duller, redder	Bluish Red Little change	Bright Red Brighter and yellower	**HUE:** Daylight Artificial light (tungsten)
1 Acetate and Cellulose—*s*	1, 2, 3	1, 2, 3 Afterchrome: Acetate, Nylon and Silk—*hs*, Cellulose—*ss* Metachrome: Acetate and Cellulose—*ss*, Nylon and Silk—*hs*	**DYEING: WOOL** Staining other fibres
		Nylon: Afterchrome (low substantivity)	**DYEING: OTHER FIBRES**
		Wool: Cr mordant Vigoureux printing	**PRINTING**

ISO Wool	ISO Wool (1)*	AATCC Wool (2)	ISO Wool (2)*	**FASTNESS PROPERTIES ETC.**
4	—	4	5	Method
—	—	—	1–2/1	Substrate
4	—	5	4–5	Alkali
—	—	5	4–5	Cross Dyeing Wool Acetic/Sulphuric
4	—	5	4–5	Carbonising
				Chlorination
				Decatising
4	—	4	4	Hot Pressing
—	—	4–5	5	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
5	6	5–6	6	normal
—	—	6–7	7	2× normal
4	5	4–5	4–5	Milling: Alkaline
—	—	—	4–5	Acid
—	—	4–5	4–5	Peroxide Bleaching
4–5	5	5	5	Perspiration
—	3–4	4	4	Potting
4–5	—	5	5	Sea Water
3	—	4–5	5	Stoving
4–5	4–5	5	5	Washing
4	5	—	5	Water
		—		Dischargeability
		Unaffected		Metal in dyebath: Copper
		Unaffected (2) Much changed (1&3)		Iron
		Slightly soluble in hot water		Solubility
				NON-TEXTILE USAGE
		In substance: H_2SO_4 conc.—reddish orange, on diln—yellow NaOH 30°Bé—violet brown		**REACTIONS**
	*Wool (2) and (3) similar	*Wool (1) very similar except fastness to potting is 2–3 Wool (2) similar but fastness to carbonising only 3		**NOTES**

C.I. Mordant Red	37	38	39
CHEMICAL CLASS	Azo		Monoazo
C.I. CONSTITUTION NUMBER			18885
HUE: Daylight	Bluish Red	Bordeaux	Bluish Red
Artificial light (tungsten)		Yellower	Somewhat yellower
DYEING: WOOL	1	1, 2	2, 3
Staining other fibres	Acetate and Cotton—*u*, Silk—*hs*	Afterchrome: Acetate and Cellulose —*u*, Silk—*hs* Metachrome: Acetate, Cotton and Silk—*ss*, Viscose—*u*	Metachrome: Acetate and Cellulose—*ss*, Silk—*hs*
DYEING: OTHER FIBRES		Nylon: Afterchrome (high substantivity)	
PRINTING	Wool: Chromium acetate, Chromate Vigoureux printing with CrF_3		

FASTNESS PROPERTIES ETC.

Method	AATCC	ISO	ISO	ISO	
Substrate	Wool	Wool	Wool (1)*	Wool (2)	Wool (3)
Alkali	—	4–5	4–5	4	—
Cross Dyeing Wool Acetic/Sulphuric	—	–/4	3/1	—	—
Carbonising	4–5	5	4	4	—
Chlorination	5	—	4	—	—
Decatising	5	4	4	4	—
Hot Pressing	5	4	3–4	4	—
Light: ⅓–½ normal	—	5–6	5–6	6–7	—
normal	6	6	6–7	6–7	—
2× normal	—	7	7	7	—
Milling: Alkaline	3–4	4	5	4–5	4
Acid	—	2	—	—	—
Peroxide Bleaching	—	—	3–4	3	—
Perspiration	4–5	5	5	5	—
Potting	4	3–4	4	2–3	2
Sea Water	4–5	—	5	5	—
Stoving	—	4–5	4–5	4–5	2–3
Washing	—	4	5	4	4–5
Water	—	—	5	5	—
Dischargeability		—	—	Not dischargeable	
Metal in dyebath: Copper		4	Marked change (1); No change (2)	Scarcely altered	
Iron		1	Strong change (1); Slight change (2)	Somewhat lighter	
Solubility		—	—	—	

NON-TEXTILE USAGE	See Leather Dyes section		
REACTIONS			
NOTES		*Wool (2) similar	

40	41	42	C.I. Mordant Red
	Monoazo 18920	Triphenylmethane	CHEMICAL CLASS C.I. CONSTITUTION NUMBER
	Dull Yellowish Red Yellower	Bright Bluish Red Little change	HUE: Daylight Artificial light (tungsten)
This C.I. Generic Name is discontinued, dyes formerly listed under it now appear under C.I. Mordant Red 36	1 Acetate and Cellulose—*u*		DYEING: WOOL Staining other fibres
	Silk: Afterchrome		DYEING: OTHER FIBRES
		Wool and Silk: Chromium lactate + urea + glycerin	PRINTING
	ISO Wool 4 –/3 4–5 — 4–5 4–5 6–7 7 7–8 4–5 — — 4–5 3 5 4 4–5 5 — 2 1–2 Suitable for package dyeing	ISO Printed Silk — — — — — — — 3–4 — 3 — — 1 — — — 2 — Not dischargeable — — —	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
			NON-TEXTILE USAGE
			REACTIONS
			NOTES

C.I. Mordant Red	43	44	45
CHEMICAL CLASS	Monoazo	Monoazo	Anthraquinone
C.I. CONSTITUTION NUMBER		16200	58230
HUE: Daylight	Bluish Red	Brilliant Bluish Red	Bordeaux (Al) Dull Bordeaux (Cr)
Artificial light (tungsten)		Duller and redder	
DYEING: WOOL	1, 2, 3	1	
Staining other fibres	Acetate, Cotton and Silk—*ss*, Viscose—*u*	Acetate—*s–hs*, Cellulose—*ss*	
DYEING: OTHER FIBRES			
PRINTING	Wool: Cr mordant Vigoureux printing		Cotton: Al or Cr mordant
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Wool (2)*	Wool	Cotton
Alkali	5	4	—
Cross Dyeing Wool Acetic/Sulphuric	4/4	—	—
Carbonising	5	4	—
Chlorination	5	—	4–5 (Al)*, 4 (Cr)*
Decatising	5	4	—
Hot Pressing	3	4	—
Light: ⅓–½ normal	5	—	—
normal	5–6	3	6 (Al), 7 (Cr)
2× normal	6–7	—	—
Milling: Alkaline	4	5	—
Acid	4	—	—
Peroxide Bleaching	4	—	—
Perspiration	5	5	—
Potting	5	—	—
Sea Water	5	4–5	—
Stoving	5	3	—
Washing	4–5	4–5	5 (Al), 5 (Cr)
Water	5	5	—
Dischargeability	Unsuitable		
Metal in dyebath: Copper	2		
Iron	3		
Solubility	Very good		
NON-TEXTILE USAGE			
REACTIONS			
NOTES	*Wool (1) and (3) similar but somewhat lower to carbonising, peroxide bleaching and potting		*Chlorine

46	47	48	C.I. Mordant Red
	Azo	Azo	CHEMICAL CLASS
			C.I. CONSTITUTION NUMBER
Red Little change	Dull Red Little change	Bright Red Little change	HUE: Daylight Artificial light (tungsten)
1, 2 Afterchrome: Acetate and Cotton—*u*, Silk—*hs*			DYEING: WOOL Staining other fibres
	Silk: Chromium lactate mordant Cotton: Pad with chromium acetate	Silk: Chromium lactate mordant Cotton: Pad with chromium mordant	DYEING: OTHER FIBRES
	Wool and Silk: Chromium lactate + urea + glycerin Cotton: Chromium acetate mordant	Wool and Silk: Chromium lactate + urea + glycerin Cotton: Chromium acetate mordant	PRINTING
ISO Wool (1) / Wool (2) — / 4–5 — / –/3–4 5 / 4 — / 4–5 — / 4–5 — / 4 — / 5 — / 6 — / 6–7 4 / 4 — / 3 — / 5 — / 5 4–5 / 4 — / 5 — / 5 — / 4–5 — / 4–5 4 4(1) 4–5 (2) 1 (1) 4 (2) —	ISO Cotton / Silk — / — — / — — / — 4–5* / — — / — — / — 3–4 / 4–5 4 / 5 5 / 6 — / 4 — / — — / — — / 4–5 — / — — / — — / — 5 / 5 — / — Dischargeable to white — — —	ISO Cotton / Silk — / — — / — — / — 4* / — — / — — / — 3–4 / 4–5 4–5 / 5–6 5 / 6–7 — / 3–4 — / — — / — — / 4 — / — — / — — / — 3–4 / 5 — / — Dischargeable to white — — —	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
			NON-TEXTILE USAGE
			REACTIONS
	*Chlorine	*Chlorine	NOTES

C.I. Mordant Red	49	50	51
CHEMICAL CLASS	Monoazo	Azo	Monoazo
C.I. CONSTITUTION NUMBER	18770		18060
HUE: Daylight	Bluish Red	Bright Bluish Red	Bluish Red
Artificial light (tungsten)	Brighter	Somewhat yellower	
DYEING: WOOL	1, 3		1
Staining other fibres	Afterchrome and Mordant: Acetate and Silk—*hs*, Cellulose—*ss*		
DYEING: OTHER FIBRES			
PRINTING		Wool, Silk and Cotton: Chromium acetate or Chromate	Wool, Silk and Cotton: Chromium acetate
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Wool (1) / Wool (3)	Cotton / Wool	Cotton
Alkali	4–5 / 4–5	— / —	—
Cross Dyeing Wool Acetic/Sulphuric	–/2 / –/2	— / —	—
Carbonising	4–5 / 4	— / —	—
Chlorination	— / —	4* / —	3*
Decatising	4–5 / 4–5	— / —	—
Hot Pressing	— / —	— / —	—
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	4–5 / 4–5	1 / —	—
normal	5 / 5	3 / —	3
2× normal	6 / 6	4 / —	—
Milling: Alkaline	5 / 4	— / —	—
Acid	4 / 4	— / —	—
Peroxide Bleaching	3–4 / 3–4	— / —	—
Perspiration	5 / 4–5	— / —	—
Potting	3–4 / 2	— / —	—
Sea Water	5 / 4–5	— / —	—
Stoving	3 / 3	— / —	—
Washing	5 / 4–5	4–5 / 4–5	4–5
Water	5 / 4–5	— / —	—
Dischargeability	Not dischargeable		Dischargeable to white
Metal in dyebath: Copper	4		—
Iron	1		—
Solubility	—		—
NON-TEXTILE USAGE			
REACTIONS	On wool: H_2SO_4 conc.—dull brown; HCl conc.—bright red; HNO_3 conc.—yellowish brown		
NOTES		*Chlorine	*Chlorine

52	53	54	C.I. Mordant Red
Triphenylmethane		Azo	CHEMICAL CLASS
			C.I. CONSTITUTION NUMBER
Bright Bluish Red Little change	Red Little change	Dull Bordeaux Brighter and yellower	HUE: Daylight Artificial light (tungsten)
	2 Acetate and Silk—*ss*, Cellulose—*u*, Nylon—*s*	1 Acetate, Cellulose and Silk—*u*	DYEING: WOOL Staining other fibres
			DYEING: OTHER FIBRES
Wool and Silk: Chromium lactate mordant + urea + glycerin	Vigoureux printing	Wool, Silk and Cotton: Cr mordant	PRINTING
ISO Silk — — — — — — — 3 — 3–4 — — 1 — — — 2 — Not dischargeable — — —	ISO Wool 4 –/3 3 — 5 4 5 6 6–7 5 — 4 5 4 5 5 5 5 — Yellower and duller Brown Very good	ISO Wool (1) 3–4 3/2 4–5 3–4 3 3–4 3 4 4 4 — 2–3 5 3–4 5 5 5 5 Good Slightly changed Much changed Suitable for package dyeing	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
			NON-TEXTILE USAGE
			REACTIONS
		Cotton print fastness: Chlorine 3–4; Light –, 3, 5; Washing 4	NOTES

C.I. Mordant Red	55	56
CHEMICAL CLASS	Azo	
C.I. CONSTITUTION NUMBER		
HUE: Daylight	Dull Bluish Red	Yellowish Red
Artificial light (tungsten)	Little change	Slightly brighter and yellower
DYEING: WOOL		2
Staining other fibres		Acetate and Cotton—*ss*, Silk—*hs*, Viscose—*u*
DYEING: OTHER FIBRES	Cotton: Pad with chromium acetate	
PRINTING	Wool and Silk: Chromium lactate + urea + glycerin Cotton: Chromium acetate mordant	
FASTNESS PROPERTIES ETC.		
Method	ISO	ISO
Substrate	Cotton	Wool
Alkali	—	2–3
Cross Dyeing Wool Acetic/Sulphuric	—	1/1
Carbonising	—	5
Chlorination	4–5*	4
Decatising	—	4
Hot Pressing	—	4
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	4–5	6–7
normal	5–6	7
2× normal	6	7–8
Milling: Alkaline	—	4
Acid	—	—
Peroxide Bleaching	—	4
Perspiration	—	5
Potting	—	2
Sea Water	—	4–5
Stoving	—	4
Washing	3–4	5
Water	—	5
Dischargeability	Dischargeable to white	—
Metal in dyebath: Copper	—	No change
Iron	—	No change
Solubility	—	—
NON-TEXTILE USAGE		
REACTIONS		
NOTES	*Chlorine	

57	58	59	C.I. Mordant Red
Disazo	Azo	Monoazo	CHEMICAL CLASS
22310		11940	C.I. CONSTITUTION NUMBER
Red Little change	Bluish Pink Little change	Dull Red Yellower	HUE: Daylight Artificial light (tungsten)
1, 2 Acetate—*ss*, Cotton, Nylon and Silk—*s*		1, 3 Afterchrome: Acetate and Silk—*hs*, Cellulose—*ss*	DYEING: WOOL Staining other fibres
	Silk: Chromium lactate mordant Cotton: Pad with chromium acetate	Silk: Afterchrome	DYEING: OTHER FIBRES
	Wool and Silk: Chromium lactate + urea + glycerin Cotton: Chromium acetate mordant		PRINTING
ISO Wool (2) 5 –/5 4 — 5 5 3 4 5 4 — 4 5 3 5 5 5 5 Fairly good to good Little change Little duller Fairly good, sensitive to hard water	ISO Cotton / Silk — — — 4–5* / — — / — — 2 / 3 3 / 4 3–4 / 4–5 — / 3–4 — — — / 4–5 — — — 5 (40°C), 3 (100°C) / 4–5 — Dischargeable to white — — —	ISO Wool (1) 5 –/5 4 — 5 4 3 4 5–6 5 — — 5 5 5 4 5 5 — 2 1 —	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
			NON-TEXTILE USAGE
			REACTIONS
For use as a direct dye or as an acid dye see C.I. Direct Red 1	*Chlorine		NOTES

C.I. Mordant Red	60	61	62
CHEMICAL CLASS	Monoazo	Azo	Triphenylmethane
C.I. CONSTITUTION NUMBER	15975		
HUE: Daylight	Red	Red	Bluish Pink
Artificial light (tungsten)	Yellower	Little change	Little change
DYEING: WOOL	1, 3		
Staining other fibres	Afterchrome: Acetate and Silk—*ss*, Cellulose—*u*		
DYEING: OTHER FIBRES		Cotton: Pad with chromium acetate	
PRINTING		Wool and Silk: Chromium lactate + urea + glycerin Cotton: Chromium acetate mordant	Wool and Silk: Chromium lactate + urea + glycerin
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Wool (1)	Cotton	Silk
Alkali	5	—	—
Cross Dyeing Wool Acetic/Sulphuric	–/5	—	—
Carbonising	5	—	—
Chlorination	—	4*	—
Decatising	5	—	—
Hot Pressing	5	—	—
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	5	3	—
normal	5–6	4–5	3
2× normal	6	5	—
Milling: Alkaline	4–5	—	3–4
Acid	—	—	—
Peroxide Bleaching	4	—	—
Perspiration	5	—	1–2
Potting	5	—	—
Sea Water	5	—	—
Stoving	5	—	—
Washing	5	4–5 (40°C), 3–4 (100°C)	2–3
Water	5	—	—
Dischargeability	Dischargeable to white	Dischargeable to white	Not dischargeable
Metal in dyebath: Copper	4	—	—
Iron	4–5	—	—
Solubility	—	—	—
NON-TEXTILE USAGE	Heavy metal salts are used as pigments		
REACTIONS			
NOTES		*Chlorine	

63	64	65	C.I. Mordant Red
	Monoazo	Disazo	CHEMICAL CLASS
		28420	C.I. CONSTITUTION NUMBER
Bright Bluish Red	Reddish Brown Redder and brighter	Bluish Red	HUE: Daylight Artificial light (tungsten)
1 Acetate—*vss*, Cellulose—*u*, Silk—*hs*	1, 2, 3 Afterchrome: Acetate and Cellulose—*ss*, Nylon and Silk—*d*	1	DYEING: WOOL Staining other fibres
			DYEING: OTHER FIBRES
Wool: Cr mordant		Wool, Silk and Cotton: Chromium acetate Printed wool: Fastness to washing 4	PRINTING
ISO Wool 4 –/2 4 — 5 4 6 6 6–7 5 3 4 4 3–4 — 4 5 5 — Unaltered Much altered —	ISO Wool (1) 4 — 5 — 4 4 — 4 — 4 — 3 5 4 5 — 5 — — Slightly yellower Much duller —	ISO Cotton — — — 4–5* — — — 4 — — — — — — — 4 — Dischargeable to white — — —	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
	Leather: On chrome tannage		NON-TEXTILE USAGE
	In substance: H_2SO_4 conc.—yellowish brown, on diln—dull yellow ppt.		REACTIONS
		*Chlorine	NOTES

C.I. Mordant Red	66	67	68
CHEMICAL CLASS	Disazo	Monoazo	Azo
C.I. CONSTITUTION NUMBER	28410	14300	
HUE: Daylight	Bluish Red	Bordeaux	Bordeaux
Artificial light (tungsten)		Yellower	Little change
DYEING: WOOL	1	1, 3	
Staining other fibres		Afterchrome: Acetate—*u*, Cellulose and Silk—*ss*	
DYEING: OTHER FIBRES			Cotton: Pad with chromium acetate
PRINTING	Wool, Silk and Cotton: Chromium acetate Printed wool: Fastness to washing 4	Wool	Wool and Silk: Chromium lactate+urea+glycerin Cotton: Chromium acetate mordant
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Cotton	Wool (1)	Cotton
Alkali	—	4–5	—
Cross Dyeing Wool Acetic/Sulphuric	—	–/2	—
Carbonising	—	5	—
Chlorination	4*	—	4*
Decatising	—	5	—
Hot Pressing	—	4–5	—
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	4	4–5	3
normal	5	5–6	4
2× normal	5–6	6	4–5
Milling: Alkaline	—	4–5	—
Acid	—	—	—
Peroxide Bleaching	—	—	—
Perspiration	—	4–5	—
Potting	—	3	—
Sea Water	—	5	—
Stoving	—	4–5	—
Washing	3–4	5	5 (40°C), 4 (100°C)
Water	—	5	—
Dischargeability	Dischargeable to white	—	Dischargeable to white
Metal in dyebath: Copper	—	3	—
Iron	—	2–3	—
Solubility	—	—	—
NON-TEXTILE USAGE			
REACTIONS			
NOTES	*Chlorine		*Chlorine

69	70	71	C.I. Mordant Red
Azo	Azo	Monoazo	CHEMICAL CLASS
		19240	C.I. CONSTITUTION NUMBER
Dull Bordeaux	Bluish Pink	Bluish Red	**HUE:** Daylight
Little change	Little change	Yellower	Artificial light (tungsten)
		1	**DYEING: WOOL**
		Acetate—*ss*, Cellulose—*u*, Silk—*hs*	Staining other fibres
Cotton: Pad with chromium acetate	Silk: Chromium lactate mordant Cotton: Pad with chromium acetate		**DYEING: OTHER FIBRES**
Wool and Silk: Chromium lactate + urea + glycerin Cotton: Chromium acetate mordant	Wool and Silk: Chromium lactate + urea + glycerin Cotton: Chromium acetate mordant	Wool: Cr mordant Vigoureux printing	**PRINTING**
			FASTNESS PROPERTIES ETC.
ISO	ISO	ISO	Method
Cotton	Cotton / Silk	Wool	Substrate
—	— / —	3–4	Alkali
—	— / —	—	Cross Dyeing Wool Acetic/Sulphuric
—	— / —	4	Carbonising
4*	4* / —	—	Chlorination
—	— / —	5	Decatising
—	— / —	4	Hot Pressing
4	3 / 4–5	6	Light: ⅛–½ normal
4	4 / 5	6–7	normal
4–5	4–5 / 6	7	2× normal
—	— / 4	5	Milling: Alkaline
—	— / —	—	Acid
—	— / —	4	Peroxide Bleaching
—	— / 4–5	5	Perspiration
—	— / —	3	Potting
—	— / —	5	Sea Water
—	— / —	4–5	Stoving
4–5 (40°C), 3–4 (100°C)	5 (40°C), 3–4 (100°C) / 4–5	5	Washing
—	— / —	5	Water
Dischargeable to white	Dischargeable to white	—	Dischargeability
—	—	Yellower, duller	Metal in dyebath: Copper
—	—	Much altered	Iron
—	—	Suitable for package dyeing	Solubility
		Fur for hats—borax clearing 5	**NON-TEXTILE USAGE**
			REACTIONS
*Chlorine	*Chlorine		**NOTES**

C.I. Mordant Red	72	73	74
CHEMICAL CLASS	Azo	Monoazo	Monoazo
C.I. CONSTITUTION NUMBER		18765	16315
HUE: Daylight	Dull Bluish Red	Bordeaux	Dull Yellowish Red
Artificial light (tungsten)	Much yellower	Unchanged	Little change
DYEING: WOOL	1	1	1, 2, 3
Staining other fibres	Acetate and Silk—*ss*, Cellulose—*u*	Acetate, Silk and Viscose—*hs*, Cotton—*ss*	Afterchrome: Acetate—*ss*, Cellulose—*u*, Silk—*hs*
DYEING: OTHER FIBRES			
PRINTING		Wool: Cr mordant Vigoureux printing	
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Wool	Wool	Wool
Alkali	3–4	4–5	4–5
Cross Dyeing Wool Acetic/Sulphuric	2–3/2	—	—
Carbonising	3–4	4–5	4–5
Chlorination	3	—	—
Decatising	3–4	4–5	5
Hot Pressing	3–4	3	4–5
Light: ⅓–½ normal	4–5	4–5	6
normal	5	5	7
2× normal	6	6	7
Milling: Alkaline	3–4, 5, 4–5	5	4–5
Acid	—	—	3
Peroxide Bleaching	2	4	3–4
Perspiration	5	5	3–4
Potting	3–4	3–4	2
Sea Water	5	5	4–5
Stoving	3	4–5	5
Washing	4–5, 5, 5	5	5
Water	5	5	5
Dischargeability	—	—	—
Metal in dyebath: Copper	Slight change	Slightly altered	Much altered
Iron	Much change	Destroyed	Somewhat altered
Solubility	—	—	—
NON-TEXTILE USAGE			
REACTIONS			
NOTES			Levels much better than C.I. Mordant Red 26 and is less susceptible to iron than C.I. Mordant Red 17

75	76	77	C.I. Mordant Red
Azo	Triphenylmethane	Xanthene	CHEMICAL CLASS
		45300	C.I. CONSTITUTION NUMBER
Bright Bluish Pink	Bright Bluish Pink	Bluish Pink	HUE: Daylight
Little change	Little change	Little change	Artificial light (tungsten)
			DYEING: WOOL
			Staining other fibres
Silk: Chromium lactate mordant Cotton: Pad with chromium acetate	Cotton: Pad with chromium acetate	Cotton: Pad with chromium acetate	DYEING: OTHER FIBRES
Wool and Silk: Chromium lactate + urea + glycerin Cotton: Chromium acetate mordant	Wool and Silk: Chromium lactate + urea + glycerin Cotton: Chromium acetate mordant	Wool and Silk: Chromium lactate + urea + glycerin Cotton: Chromium acetate mordant	PRINTING
ISO Cotton / Silk	ISO Cotton	ISO Cotton	FASTNESS PROPERTIES ETC.
— / —	—	—	Method
— / —	—	—	Substrate
— / —	—	—	Alkali
4–5* / —	4–5*	4–5*	Cross Dyeing Wool Acetic/Sulphuric
— / —	—	—	Carbonising
			Chlorination
— / —	—	—	Decatising
			Hot Pressing
1–2 / 3	2	2	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
2 / 4	2	2	normal
3 / 4–5	2–3	2–3	2× normal
— / 4	—	—	Milling: Alkaline
— / —	—	—	Acid
— / —	—	—	Peroxide Bleaching
— / 4–5	—	—	Perspiration
— / —	—	—	Potting
			Sea Water
— / —	—	—	Stoving
— / —	—	—	Washing
4–5 (40°C), 3 (100°C) / 4–5	4 (40°C), 3 (100°C)	4 (40°C), 3 (100°C)	Water
— / —	—	—	
Dischargeable to white	Not dischargeable	Not dischargeable	Dischargeability
			Metal in dyebath: Copper
			Iron
			Solubility
			NON-TEXTILE USAGE
			REACTIONS
*Chlorine	*Chlorine	*Chlorine	NOTES

C.I. Mordant Red	78	79	80
CHEMICAL CLASS	Triphenylmethane	Azo	Disazo
C.I. CONSTITUTION NUMBER			26565
HUE: Daylight	Bluish Red	Bluish Red	Dull Red
Artificial light (tungsten)	Little change	Little change	Somewhat yellower
DYEING: WOOL			1
Staining other fibres			Acetate—*ss*, Cellulose—*u*, Silk—*hs*
DYEING: OTHER FIBRES	Cotton: Pad with chromium acetate	Cotton: Pad with chromium acetate	
PRINTING	Wool and Silk: Chromium lactate+urea+glycerin Cotton: Chromium acetate mordant	Wool and Silk: Chromium lactate+urea+glycerin Cotton: Chromium acetate mordant	Wool: Chromium acetate
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	AATCC
Substrate	Cotton	Cotton	Wool
Alkali	—	—	4
Cross Dyeing Wool Acetic/Sulphuric	—	—	—
Carbonising	—	—	4
Chlorination	4–5*	4*	—
Decatising	—	—	5
Hot Pressing	—	—	4
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	2	3	—
normal	2	4	5
2× normal	2–3	4	—
Milling: Alkaline	—	—	4
Acid	—	—	1
Peroxide Bleaching	—	—	2
Perspiration	—	—	5
Potting	—	—	4
Sea Water	—	—	5
Stoving	—	—	3
Washing	4 (40°C), 3 (100°C)	4 (40°C), 3–4 (100°C)	5
Water	—	—	5
Dischargeability	Not dischargeable	Dischargeable to white	Dischargeable to white
Metal in dyebath: Copper	—	—	Slightly bluer and purer
Iron	—	—	Somewhat bluer and duller
Solubility	—	—	—
NON-TEXTILE USAGE			
REACTIONS			
NOTES	*Chlorine	*Chlorine	

81	82	C.I. Mordant Red
		CHEMICAL CLASS
		C.I. CONSTITUTION NUMBER
Bright Bluish Red	Bright Yellowish Red	HUE: Daylight Artificial light (tungsten)
		DYEING: WOOL Staining other fibres
		DYEING: OTHER FIBRES
		PRINTING
		FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
Anodised aluminium. Fastness: Light 6–7; Weather, fairly good to good; Heat (*a*) 6 h at 200°C lighter, (*b*) 1 h at 250°C much lighter	Anodised aluminium. Fastness: Light 6–7; Weather, very good; Heat (*a*) 6 h at 200°C good; (*b*) 1 h at 250°C good	NON-TEXTILE USAGE
		REACTIONS
		NOTES

C.I. Mordant Red	83	84
CHEMICAL CLASS		
C.I. CONSTITUTION NUMBER		
HUE: Daylight	Bright Red	Bright Red
Artificial light (tungsten)		
DYEING: WOOL		
Staining other fibres		
DYEING: OTHER FIBRES		
PRINTING		
FASTNESS PROPERTIES ETC.		
Method		
Substrate		
Alkali		
Cross Dyeing Wool Acetic/Sulphuric		
Carbonising		
Chlorination		
Decatising		
Hot Pressing		
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal		
normal		
2× normal		
Milling: Alkaline		
Acid		
Peroxide Bleaching		
Perspiration		
Potting		
Sea Water		
Stoving		
Washing		
Water		
Dischargeability		
Metal in dyebath: Copper		
Iron		
Solubility		
NON-TEXTILE USAGE	Anodised aluminium. Fastness: Light 7; Weather, good to very good; Heat (*a*) 6 h at 200°C good, (*b*) 1 h at 250°C good	Anodised aluminium. Fastness: Light 6–7; Weather, good; Heat (*a*) 6 h at 200°C little weaker, (*b*) 1 h at 250°C much weaker
REACTIONS		
NOTES		

85	86	C.I. Mordant Red
Monoazo	Monoazo	CHEMICAL CLASS
		C.I. CONSTITUTION NUMBER
Dull Bluish Red Yellower	Bluish Red Slightly bluer	HUE: Daylight Artificial light (tungsten)
1, 2, 3 Afterchrome and Mordant: Acetate—*s*, Cotton—*ss*, Nylon and Silk—*d*, Viscose—*u* Metachrome: Acetate and Cotton—*s*, Nylon and Silk—*d*, Viscose—*ss*	2	DYEING: WOOL Staining other fibres
Silk: Afterchrome, Metachrome	Silk: Metachrome	DYEING: OTHER FIBRES
		PRINTING
ISO Wool (2)* Silk 4–5 — — — 5 — 4 — 4–5 — 4 4 6 5–6 6–7 6 6–7 6 3–4 — — — 4 — 5 5 4 — 4–5 — 4 — 4 4–5 5 5 Dischargeable to moderate white Slightly yellower Slightly yellower and duller (2), becomes brown (1) and (3) Soluble in hot and cold water	ISO Wool 4–5 –/5 5 — 5 dry 4 5 6 7 4 — 4 4–5 3–4 5 5 4–5 5 — Yellower Duller Soluble in hot and cold water	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
		NON-TEXTILE USAGE
	In substance: H_2SO_4 conc. —reddish orange, on diln—yellowish orange	REACTIONS
*Wool (1) and (3) very similar		NOTES

C.I. Mordant Red	87	88	89
CHEMICAL CLASS	Monoazo	Azo	Azo
C.I. CONSTITUTION NUMBER			
HUE: Daylight	Dull Bluish Red	Bluish Red	Brilliant Red
Artificial light (tungsten)	Yellower		
DYEING: WOOL	1, 2	1	1
Staining other fibres	Afterchrome: Acetate and Cellulose—*u*, Nylon and Silk—*hs* Metachrome: Acetate and Cellulose—*ss*, Nylon and Silk—*hs*	Acetate and Cellulose—*u*, Nylon—*hs*, Silk—*s*	
DYEING: OTHER FIBRES		Nylon: Afterchrome	Nylon and Silk: Afterchrome
PRINTING			Wool: Cr mordant
FASTNESS PROPERTIES ETC.			
Method	AATCC	ISO	
Substrate	Wool (1)	Wool	Nylon
Alkali	—	4–5	5
Cross Dyeing Wool Acetic/Sulphuric	3–4/4	–/4	—
Carbonising	5	4–5	—
Chlorination	4 (weaker)	4–5	—
Decatising	—	4	—
Hot Pressing	4–5 (dry)	2 (dry)	—
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	3	5	5
normal	4	6	6
2× normal	—	7	6
Milling: Alkaline	4–5	4	4–5
Acid	—	4	—
Peroxide Bleaching	—	3–4	—
Perspiration	4–5	5	—
Potting	3	4–5	—
Sea Water	—	5	—
Stoving	—	—	—
Washing	4–5	4	4–5
Water	—	5	—
Dischargeability	—	Dischargeable to white	
Metal in dyebath: Copper	1	Yellower	
Iron	1	Destroyed	
Solubility	Soluble in cold and hot water	—	
NON-TEXTILE USAGE			
REACTIONS	In substance: H_2SO_4 conc. —yellowish brown, on diln—yellowish orange		
NOTES			

90	91	92	C.I. Mordant Red
Monoazo	Monoazo	Disazo	CHEMICAL CLASS
17047		26905	C.I. CONSTITUTION NUMBER
Bright Bluish Red	Bluish Red	Red	HUE: Daylight
		Little change	Artificial light (tungsten)
		1	DYEING: WOOL
			Staining other fibres
	Silk: Formic acid + mordant Cellulose: Pad with Chromium acetate or Chromate Suitable for dischargeable grounds		DYEING: OTHER FIBRES
	Wool, Silk and Cellulose: Pad with Chromate or Chromium acetate		PRINTING
ISO Wool	ISO Silk (dyed) Cellulose (dyed and printed)	AATCC Wool (1)	FASTNESS PROPERTIES ETC. Method
4	— —	3	Substrate
5/–	— —	—	Alkali
4	— —	5	Cross Dyeing Wool Acetic/Sulphuric
4–5	— —	4–5	Carbonising
5	— —	4	Chlorination
			Decatising
4	— —	—	Hot Pressing
—	— —	—	Light: ⅓–½ normal
6–7	4 4	4–5	normal
7	— —	—	2× normal
4	— —	4	Milling: Alkaline
5	— —	—	Acid
—	— —	2	Peroxide Bleaching
5	4–5 —	4	Perspiration
5	— —	—	Potting
4–5	— —	4	Sea Water
3–4	— —	3	Stoving
4–5	4 3–4	4	Washing
—	— —	—	Water
—	Neutral and alkaline very good	Good	Dischargeability
1	—	Bluer and duller	Metal in dyebath: Copper
4	—	Duller	Iron
—	Good	Good	Solubility
			NON-TEXTILE USAGE
			REACTIONS
		For use as an acid dye see C.I. Acid Red 66	NOTES

C.I. Mordant Red	93	94	
CHEMICAL CLASS	Monoazo	Monoazo	
C.I. CONSTITUTION NUMBER	**27015**	**18841**	
HUE: Daylight	Dark Red	Red	
Artificial light (tungsten)			
DYEING: WOOL	3	2, 3	
Staining other fibres		Acetate 4–5, Cotton 5	
DYEING: OTHER FIBRES			
PRINTING			
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	
Substrate	Wool (3)	Wool (3)	
Alkali	good	4–5	
Cross Dyeing Wool Acetic/Sulphuric	—	4–5/4	
Carbonising	good	4–5	
Chlorination	—	3–4	
Decatising	—	4–5	
Hot Pressing	—	—	
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	—	5–6	
normal	moderate	6–7	
2× normal	—	7	
Milling: Alkaline	moderate	4	
Acid	—	4	
Peroxide Bleaching	—	3–4	
Perspiration	—	5	
Potting	—	3–4	
Sea Water	—	5	
Stoving	good	4	
Washing	very good	5	
Water	—	—	
Dischargeability	—	—	
Metal in dyebath: Copper	—	4–5 greener	
Iron	—	2	
Solubility	—	duller	
NON-TEXTILE USAGE			
REACTIONS			
NOTES	For use as an acid dye see C.I. Acid Red 177		

C.I. Mordant Violet	1	2	3
CHEMICAL CLASS	Triphenylmethane	Monoazo	Triphenylmethane
C.I. CONSTITUTION NUMBER	**43565**	**14670**	
HUE: Daylight	Bright Violet	Reddish Violet	Bright Violet
Artificial light (tungsten)	Redder	Yellower	Redder
DYEING: WOOL	1, 2, 3	1	
Staining other fibres	Afterchrome: Acetate and Cellulose—*ss*, Silk—*hs* Metachrome: Acetate—*ss* Cellulose and Silk—*hs*	Acetate and Cellulose—*u* Silk—*ss*	Very similar in properties and uses to C.I. Mordant Violet 1 but chemically slightly different
DYEING: OTHER FIBRES	Silk: Mordant Nylon: Afterchrome, boil 90–120 min for lake formation Cotton: Pad with chromium acetate		
PRINTING	Wool: Chromium acetate, Chromate Silk: Chromate or Chromium lactate + urea + glycerin Cotton: Chromium acetate Vigoureux printing		

FASTNESS PROPERTIES ETC.

Method	AATCC	ISO	ISO
Substrate	Wool (1)	Wool (1)*	Wool
Alkali	3–4	3–4	4–5
Cross Dyeing Wool Acetic/Sulphuric	4–5/3–4	4–5/4–5	—
Carbonising	3	3	5
Chlorination	3	3–4	—
Decatising	5	5	4–5
Hot Pressing	dry 3, wet 5	5	
Light: ⅓–½ normal	3	3	5–6
normal	4	4	6
2× normal	5	4–5	6–7
Milling: Alkaline	4	4	4
Acid	—	4	—
Peroxide Bleaching	1–2	3	—
Perspiration	5	5	4–5
Potting	4–5	4–5	2
Sea Water	5	5	5
Stoving	3–4	4–5	3–4
Washing	4–5	4	5
Water	5	5	5
Dischargeability	Not suitable		Good
Metal in dyebath: Copper	Unaffected		—
Iron	Redder and duller		—
Solubility	—		—

NON-TEXTILE USAGE	See Leather Dyes section		
REACTIONS	On wool: HNO_3 conc.—dull reddish orange spot, greenish rim		
NOTES	*Wool (2) very similar Dyed silk: Light 4–5, 6, 7; Milling 4, Perspiration 4–5; Washing 4–5 Printed wool: Milling 4, Stoving 3–4, Washing 5 Printed cotton: Chlorine 3–4; Light 5, 5–6, 6–7; Washing 4		

C.I. Mordant Violet	4	5
CHEMICAL CLASS	Monoazo	Monoazo
C.I. CONSTITUTION NUMBER	**14760**	**15670**
HUE: Daylight	Dull Violet	Dull Reddish Violet
Artificial light (tungsten)	Much redder	Redder and brighter
DYEING: WOOL	1, 2, 3	1, 2, 3
Staining other fibres	Afterchrome: Acetate—*s*, Cotton—*ss*, Silk—*hs*, Viscose—*u* Metachrome:—Acetate—*ss*, Cellulose—*u*, Silk—*hs* Mordant: Acetate and Viscose—*u*, Cotton—*s*, Silk—*hs*	Afterchrome: Acetate—*s*, Cotton—*u*, Nylon and Silk—*hs*, Viscose—*ss* Metachrome and Mordant: Acetate—*s*, Cellulose—*u*, Silk—*hs*
DYEING: OTHER FIBRES	Silk: Afterchrome, Mordant Nylon: Afterchrome	Silk: Mordant Nylon: Afterchrome
PRINTING		Wool: Chromium acetate Vigoureux printing

FASTNESS PROPERTIES ETC.

Method	ISO		AATCC	ISO	ISO	ISO
Substrate	Wool (2)*	Silk	Wool (1)	Wool (1)	Wool (2)	Silk
Alkali	5	—	5	3–4	4–5	—
Cross Dyeing Wool Acetic/Sulphuric	4/2	3/2	4/3	3–4/3	4/3–4	1–2/1–2
Carbonising	4–5	—	5	4	4	—
Chlorination	4	—	—	4–5	4–5	—
Decatising	4–5	—	5	4–5	4–5	—
Hot Pressing	3–4	3	4	3–4	3	3
Light: ⅓–½ normal	5–6	5–6	5	5–6	5–6	5–6
normal	6	6	6	6	6	6
2× normal	6–7	6–7	7	6–7	6–7	6–7
Milling: Alkaline	4–5	4	4–5	4	2–3	3–4
Acid	4	—	—	3–4	3–4	—
Peroxide Bleaching	3	2–3	2–3	2	2	1
Perspiration	5	4	5	4–5	4–5	3
Potting	3	—	3	3	3–4	—
Sea Water	5	—	5	5	5	—
Stoving	4–5	4	5	5	5	2–3
Washing	5	4–5	4–5	5	5	3–4
Water	5	4	5	5	5	3
Dischargeability	Very good					
Metal in dyebath: Copper	Redder 2–3 (1), 3–4 (2), 2–3 (1)				3–4	
Iron	Destroyed (1) Much duller (2) and (3)				—	
Solubility	Poor				—	

NON-TEXTILE USAGE	See Leather Dyes section	See Leather Dyes section
REACTIONS	On wool: H_2SO_4 conc.—greenish black HCl conc.—dull violet HNO_3 conc.—light brown	On wool: HNO_3 conc.—dull brownish red
NOTES	*Wool (1) and (2) similar	

6	7	8	C.I. Mordant Violet
Triphenylmethane **43510**	Azo	Triphenylmethane **43515**	**CHEMICAL CLASS** **C.I. CONSTITUTION NUMBER**
Bright Violet Much redder	Bluish Violet Redder	Bright Violet Redder	**HUE:** Daylight Artificial light (tungsten)
2 Acetate, Cellulose and Silk—*ss*	1, 2, 3 Afterchrome: Acetate and Cellulose—*u*—*hs* Silk—*ss*—*hs*	1, 2 (dyeings much weaker than by 1) Afterchrome: Acetate and Cellulose—*ss*, Silk—*hs*	**DYEING: WOOL** Staining other fibres
Silk: Afterchrome	Silk: Cr mordant	Silk: Afterchrome (poor fastness to light)	**DYEING: OTHER FIBRES**
		Cotton: Chromate	**PRINTING**
ISO Wool / Silk 3 / — — / — 4–5 / — — / — 5 / — 4 / 3–4 3 / — 4 / 2 4 / — 4–5 / 3–4 1 / — 1 / 2 5 / 5 4 / — 5 / 5 3 / — 4–5 / 5 5 / 5 — Little change Slightly bluer —	ISO Wool (2)† / Silk* 5 / — 4/2 / 3/2 4 / — 3–4 / — 4 / — 3 / 3 5–6 / 5–6 6 / 6 6–7 / 6–7 4–5 / 4 4–5 / — 3 / 2–3 5 / 4 3–4 / — 5 / — 4 / 4 5 / 4–5 5 / 5 Dischargeable to white 3 2 —	ISO Wool (1) 3 — 4 — 5 3–4 3 4 4–5 4 3 1 4–5 3–4 5 4 — 5 — 5 1 Suitable for package dyeing	**FASTNESS PROPERTIES ETC.** Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
		See Leather Dyes section	**NON-TEXTILE USAGE**
			REACTIONS
	*Dyed with basic chromium chloride †Wool (1) and (3) very similar		**NOTES**

C.I. Mordant Violet	9	10
CHEMICAL CLASS		Triphenylmethane
C.I. CONSTITUTION NUMBER		43555
HUE: Daylight	Dull Reddish Violet	Bright Violet
Artificial light (tungsten)	Much redder	Much redder
DYEING: WOOL	1, 2, 3	1, 2
Staining other fibres	Metachrome: Acetate—*s*, Cellulose—*ss*, Silk—*hs*	Afterchrome: Acetate—*u*, Cellulose—*ss*
DYEING: OTHER FIBRES		Silk: Afterchrome
PRINTING	Silk: Cr mordant	Wool and Silk: Cr mordant Cotton: Chromium acetate
FASTNESS PROPERTIES ETC.		
Method	ISO	ISO
Substrate	Wool (2)*	Wool (1) / Printed Silk
Alkali	3–4	3 / —
Cross Dyeing Wool Acetic/Sulphuric	4/2	— / —
Carbonising	2	— / —
Chlorination	3	— / —
Decatising	4–5	5 / —
Hot Pressing	3–4	5 / 3–4
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	4	3 / —
normal	5	4 / 3
2× normal	5–6	4 / —
Milling: Alkaline	4–5	4 / 3–4
Acid	3–4	4 / —
Peroxide Bleaching	3	1 / 1
Perspiration	4–5	5 / 5
Potting	3–4	5 / —
Sea Water	4–5	5 / —
Stoving	3	4 / 5
Washing	5	4 / 5
Water	5	5 / 5
Dischargeability	Dischargeable to white	Dischargeable to white
Metal in dyebath: Copper	4	Slightly bluer and duller
Iron	1	Slightly redder and duller
Solubility	—	—
NON-TEXTILE USAGE		Hats, borax clearing 5
REACTIONS	In substance: H_2SO_4 conc.—orange brown. On wool: H_2SO_4 conc.—dull brown, HCl conc. —dull bordeaux, HNO_3 conc.—reddish orange	—
NOTES	*Wool (1) and (3) very similar	

11	12	13	C.I. Mordant Violet
Triphenylmethane	Disazo		CHEMICAL CLASS
43550	28490		C.I. CONSTITUTION NUMBER
Bright Bluish Violet Redder	Violet Slightly redder	Dull Violet Redder	HUE: Daylight Artificial light (tungsten)
1, 2, 3 Afterchrome: Acetate and Viscose—*ss*, Cotton—*u* Metachrome: Acetate and Cellulose—*ss*, Silk—*hs*	1	1, 2, 3	DYEING: WOOL Staining other fibres
Silk and Nylon: Afterchrome, Mordant			DYEING: OTHER FIBRES
Wool and Silk: Chromium acetate Cotton: Chromium acetate, Chromate Nylon: Chromium acetate	Wool, Silk and Cotton: Chromium acetate		PRINTING

AATCC Wool (1)	ISO Wool (1)*	Silk	ISO Cotton	ISO Wool (1)	ISO Wool (2)	FASTNESS PROPERTIES ETC.
3–4	3–4	—	—	—	—	Method
5/4	3/3–4	—	—	—	—	Substrate
4	4	—	—	—	—	Alkali
—	3–4	—	3*	—	—	Cross Dyeing Wool Acetic/Sulphuric
5	5	—	—	—	—	Carbonising
						Chlorination
4	4	3–4	—	—	—	Decatising
3	3	3	3	—	—	
4	4	4	3	5–6	4–5	Hot Pressing
5	4–5	4–5	3	—	—	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
4	4	3	—	5	5	normal
—	4	—	—	—	—	2× normal
1	1	1	—	—	—	Milling: Alkaline
5	4–5	5	—	5	5	Acid
5	3–4	—	—	4	3–4	Peroxide Bleaching
						Perspiration
5	5	—	—	—	—	Potting
4	3	4	—	—	—	
4–5	4–5	5	4†	5	5	Sea Water
5	5	5	—	5	5	Stoving
						Washing
						Water
Dischargeable to white			Dischargeable to white		—	
Unaltered			—		—	Dischargeability
Duller			—		—	Metal in dyebath: Copper
—			—		—	Iron
						Solubility

			NON-TEXTILE USAGE
On wool: HNO_3 conc.—reddish violet to dark red			REACTIONS
*Wool (2) similar	*Chlorine †Printed wool 4		NOTES

C.I. Mordant Violet	14	15
CHEMICAL CLASS	Azo	Triphenylmethane
C.I. CONSTITUTION NUMBER		43560
HUE: Daylight	Violet	Reddish Violet
Artificial light (tungsten)	Much duller and redder	Much redder
DYEING: WOOL	1, 2, 3	1, 2, 3
Staining other fibres	Afterchrome: Acetate—*s*, Cotton—*ss*, Viscose—*u* Metachrome: Acetate—*s*, Cellulose—*ss*	Metachrome: Acetate and Viscose—*u*, Cotton and Silk—*ss*
DYEING: OTHER FIBRES	Silk: Afterchrome, Mordant	Silk: Afterchrome
PRINTING		

FASTNESS PROPERTIES ETC.

Method	ISO		ISO		ISO
Substrate	Wool (1)	Wool (2)	Wool (1)	Wool (2)	Silk
Alkali	4–5	5	3–4	2–3	—
Cross Dyeing Wool Acetic/Sulphuric	—	—	—	—	—
Carbonising	4	3–4	4	4	—
Chlorination	3	4	—	—	—
Decatising	5	5	5	5	—
Hot Pressing	3 bluer	3 bluer	4	4	3
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	5	5	4	4	—
normal	6–7	6	5	5	3
2× normal	7	6–7	5–6	5–6	—
Milling: Alkaline	3	4	4	4	4–5
Acid	—	—	3	2	—
Peroxide Bleaching	1	1–2	1	1	1
Perspiration	4	4	5	4	5
Potting	2	3	5	4–5	—
Sea Water	4	4	5	5	—
Stoving	4–5	4	4	4	5
Washing	3–4	4–5	4–5	4–5	5
Water	4–5	4–5	5	5	5
Dischargeability	Not dischargeable		Dischargeable to white		
Metal in dyebath: Copper	Little redder (1), little weaker, trace redder (2)			—	
Iron	Redder, duller (1), trace redder (2)			—	
Solubility	Suitable for package dyeing			—	

NON-TEXTILE USAGE	See Leather Dyes section	
REACTIONS		
NOTES		

16	17	18	C.I. Mordant Violet
Triphenylmethane	Triphenylmethane	Triphenylmethane	CHEMICAL CLASS
43865	43866	44015	C.I. CONSTITUTION NUMBER
Bright Reddish Violet Redder	Bright Reddish Violet Redder	Bright Violet Much redder	HUE: Daylight Artificial light (tungsten)
1 Acetate and Cotton—*u*, Silk—*s*, Viscose—*ss*	Application and properties very similar to those of C.I. Mordant Violet 16	2	DYEING: WOOL Staining other fibres
Silk: Afterchrome, Mordant Nylon: Afterchrome (medium substantivity) Cotton: Pad with chromium acetate		Silk: Afterchrome	DYEING: OTHER FIBRES
Wool and Cotton: Chromium acetate, Chromate Silk: Chromium acetate		Wool and Silk: Cr mordant Cotton: Cr mordant and dyeing on a discharged mordant	PRINTING
AATCC Wool (1) / ISO Wool (1) / ISO Silk*		ISO Silk / ISO Cotton	FASTNESS PROPERTIES ETC.
— / 3 / —		— / —	Method
— / 5/4 / —		— / —	Substrate
2 / 4 / —		— / —	Alkali
4–5 / 3–4 / —		— / 2–3*	Cross Dyeing Wool Acetic/Sulphuric
4–5 / 5 / —		—	Carbonising
			Chlorination
			Decatising
4–5 / 4 / 3		4–5 / —	Hot Pressing
— / 4 / —		— / —	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
4–5 / 4 / 3–4		3 / 1–2	normal
— / 4–5 / —		— / —	2× normal
2–3 / 5 / 4–5		2–3 / —	Milling: Alkaline
— / — / —		— / —	Acid
— / 1 / 1		2 / —	Peroxide Bleaching
4–5 / 5 / 4–5		5 / —	Perspiration
3 / 5 / —		— / —	Potting
5 / 5 / —		— / —	Sea Water
— / 4 / 5		5 / —	Stoving
— / 4 / 4–5		3–4 / 4–5	Washing
— / — / 5		5 / —	Water
Good		Dischargeable to white	Dischargeability
3–4		—	Metal in dyebath: Copper
2–3		—	Iron
—		—	Solubility
			NON-TEXTILE USAGE
			REACTIONS
*Printed Wool: Milling 4, Stoving 4, Washing 4–5 Printed Cotton: Chlorine 3; Light 1, 2, 2; Washing 4–5		*Chlorine Fastness to washing of printed wool 5	NOTES

C.I. Mordant Violet	19	20
CHEMICAL CLASS	Triphenylmethane	Triphenylmethane
C.I. CONSTITUTION NUMBER	43551	
HUE: Daylight	Violet	Bright Bluish Violet
Artificial light (tungsten)	Slighty redder	Redder
DYEING: WOOL	1, 2	1, 2
Staining other fibres	Afterchrome: Acetate—*s*, Cotton—*u*, Viscose—*ss* Metachrome: Acetate and Cellulose—*ss*, Silk—*hs*	Metachrome: Acetate, Cellulose and Silk—*hs*, Nylon—*s*
DYEING: OTHER FIBRES	Silk: Afterchrome	
PRINTING	Wool, Silk and Cotton: Cr mordant Vigoureux printing	
FASTNESS PROPERTIES ETC.		
Method	ISO	AATCC
Substrate	Wool (1) / Wool (2)	Wool (2)
Alkali	4 / 3	3
Cross Dyeing Wool Acetic/Sulphuric	— / —	—
Carbonising	3–4 / 2–3	3
Chlorination	— / —	—
Decatising	4 / 4	5
Hot Pressing	5 / 4–5	4
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	3 / 3	—
normal	4 / 4	3–4
2× normal	4 / 4	—
Milling: Alkaline	4 / 4	4–5
Acid	4 / 2–3	—
Peroxide Bleaching	1–2 / 1	1
Perspiration	5 / 4	5
Potting	5 / 4–5	4
Sea Water	5 / 5	5
Stoving	4 / 3	4
Washing	4–5 / 4	4–5
Water	5 / 4	—
Dischargeability	Dischargeable to white	Unsuitable
Metal in dyebath: Copper	Unaltered (1), Slightly duller (2)	Slightly weaker
Iron	Duller (1 and 2)	Slightly bluer
Solubility	—	Suitable for package dyeing
NON-TEXTILE USAGE	Loose wool and rabbit fur for hats—borax clearing 5	
REACTIONS		In substance: H_2SO_4 conc.—orange, on diln.—colourless On wool: HNO_3 conc.—bright green
NOTES		

21	22	23	C.I. Mordant Violet
Triphenylmethane		Triphenylmethane	CHEMICAL CLASS
		43540	C.I. CONSTITUTION NUMBER
Bright Bluish Violet Redder	Dull Bluish Violet Much Redder	Bright Reddish Violet Redder and brighter	HUE: Daylight Artificial light (tungsten)
Slightly different chemically from C.I. Mordant Violet 20 but very similar in properties and uses	1, 2, 3 Afterchrome: Acetate—*s*, Cotton—*ss*, Viscose—*u* Metachrome: Acetate—*ss*, Cellulose—*u*, Silk—*hs* Mordant: Acetate and Viscose—*u*, Cotton—*s*, Silk—*hs*	1 Acetate and Cellulose—*v*, Silk—*hs*	DYEING: WOOL Staining other fibres
	Silk: Afterchrome, Mordant Nylon: Afterchrome		DYEING: OTHER FIBRES
		Cotton: Chromate	PRINTING
	ISO Wool (1), (2) and (3) 5 4/2 4 3–4 4 3 5–6 6 6–7 4–5 4–5 3–4 5 3–4 5 4 5 5 Very good 3 2 Poor	ISO Wool 3–4 — 4 — 4 3 3 4 4–5 5 3 3 4–5 — 5 4 4 5 — 2–3 2–3 —	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
			NON-TEXTILE USAGE
			REACTIONS
			NOTES

C.I. Mordant Violet	24	25
CHEMICAL CLASS	Azo (metallised)	Xanthene
C.I. CONSTITUTION NUMBER		45445
HUE: Daylight	Bright Violet	Bluish Violet
Artificial light (tungsten)	Redder	Somewhat redder
DYEING: WOOL		3
Staining other fibres		Acetate, Cellulose, Nylon and Silk—*ss*
DYEING: OTHER FIBRES		Silk and Nylon: Mordant
PRINTING	Cotton: Chromium acetate	

FASTNESS PROPERTIES ETC.

Method	ISO	AATCC	ISO	ISO	
Substrate	Cotton	Wool	Wool	Silk (Al)	Silk (Cr)
Alkali	—	5	4	—	—
Cross Dyeing Wool Acetic/Sulphuric	—	—	–/2	–/1–2	–/2
Carbonising	—	3	1	—	—
Chlorination	3–4*	—	—	—	—
Decatising	—	5	4	—	—
Hot Pressing	—	5	4–5	3	3
Light: ⅓–½ normal	5	—	3–4	3	2
normal	5–6	4–5	4	3	2
2× normal	6–7	—	4	3–4	2–3
Milling: Alkaline	—	5	4	4	4
Acid	—	—	—	—	—
Peroxide Bleaching	—	—	3	3–4	1
Perspiration	—	5	5	2	5
Potting	—	5	3–4	—	—
Sea Water	—	5	5	—	—
Stoving	—	4	4–5	2	5
Washing	4	5	4	5	5
Water	—	—	5	5	5
Dischargeability	—	Not dischargeable			
Metal in dyebath: Copper	—	Somewhat duller			
Iron	—	Much brighter			
Solubility	—	Slightly water-sol., soluble in presence of ammonia			

NON-TEXTILE USAGE	Biological stain Indicator Leather: On chrome tannage
REACTIONS	
NOTES	*Chlorine

C.I. Mordant Violet

26	27	28	
Anthraquinone	Triphenylmethane	Triphenylmethane	CHEMICAL CLASS
58500	43860	43570	C.I. CONSTITUTION NUMBER
Violet (Cr) Dull Reddish Violet (Al)	Violet Much redder	Bright Bluish Violet Much redder	**HUE:** Daylight Artificial light (tungsten)
3 Acetate—*ss–s* Cellulose—*ss* Silk—*s*	1 Acetate and Cellulose—*u* Silk—*hs*	1, 2 Afterchrome: Acetate—*ss*, Cellulose—*u* Metachrome: Acetate—*ss*, Cellulose and Silk—*hs*	**DYEING: WOOL** Staining other fibres
	Silk: Afterchrome	Silk: Afterchrome, Mordant Nylon: Afterchrome (high substantivity)	**DYEING: OTHER FIBRES**
	Wool, Silk and Cotton: Chromium acetate	Wool: Chromium acetate, Chromate Silk: Chromate Vigoureux printing	**PRINTING**

ISO Wool	Wool	ISO Silk	Cotton	AATCC Wool (1)	ISO Wool (1)	**FASTNESS PROPERTIES ETC.**
4–5	4	—	—	—	3–4	Method
—	—	—	—	—	–/5	Substrate
1	4	—	—	—	3–4	Alkali
3	—	—	2–3*	4–5	5	Cross Dyeing Wool Acetic/Sulphuric
4	5	—	—	5	5	Carbonising
						Chlorination
—	5	3–4	—	5	4–5	Decatising
—	3	—	—	—	3	Hot Pressing
6	4	3	1	4	4	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
—	4–5	—	—	—	4–5	normal
4–5	4	2–3	—	3–4	4	2× normal
—	4	—	—	—	4	Milling: Alkaline
3	1–2	1	—	—	1–2	Acid
5	4–5	5	—	4–5	5	Peroxide Bleaching
4	5	—	—	4–5	5	Perspiration
						Potting
5	5	4	—	5	5	Sea Water
5	4	—	—	4–5	5	Stoving
4–5	4	5	5	—	5	Washing
—	5	5	—	—	5	Water
—	Dischargeable to white			Unsuitable		Dischargeability
4	Little effect			Slightly affected		Metal in dyebath: Copper
4	Little effect			Slightly affected		Iron
—	—			—		Solubility
Biological stain	Loose wool and fur for hats, borax clearing 5			See Leather Dyes section		**NON-TEXTILE USAGE**
						REACTIONS
	*Chlorine					**NOTES**

C.I. Mordant Violet	29	30		31		
CHEMICAL CLASS		Monoazo				
C.I. CONSTITUTION NUMBER		15700				
HUE: Daylight	Reddish Violet	Bright Bluish Violet		Dull bluish violet		
Artificial light (tungsten)	Much redder	Slightly redder		Slightly redder		
DYEING: WOOL	Slightly different chemically from C.I. Mordant Violet 28 but very similar in properties and uses	1, 2, 3		1, 2, 3		
Staining other fibres		Afterchrome: Cotton—*ss*		Cotton (afterchrome)—*ss*		
DYEING: OTHER FIBRES						
PRINTING						
FASTNESS PROPERTIES ETC.						
Method		AATCC	ISO		ISO	
Substrate		Wool (1)	Wool (1)	Wool (1)	Wool (2)	Wool (3)
Alkali		—	—	—	—	—
Cross Dyeing Wool Acetic/Sulphuric		—	3–4/3	3–4/3	3–4/3	3–4/3
Carbonising		4	4–5	3–4	4–5	3
Chlorination		5	5	5	5	4–5
Decatising		5	5	5	5	5
Hot Pressing		4–5	3	3	3	3
Light: ⅓–½ normal		—	—	—	—	—
normal		5–6	7	7	7	7
2× normal		—	8	8	8	8
Milling: Alkaline		4–5	4–5	4–5	4–5	4–5
Acid		—	3	4	3	3
Peroxide Bleaching		—	4	3–4	4	4
Perspiration		4–5	5	5	5	5
Potting		4	4–5	4	4–5	4
Sea Water		5	5	5	5	5
Stoving		—	5	5	5	4–5
Washing		—	5	5	5	5
Water		—	5	5	5	5
Dischargeability		4			—	
Metal in dyebath: Copper		4 (1)	4–5 (1)	1 (1)	2–3 (2)	2 (3)
Iron		2 (1)	4 (1)	1 (1)	2–3 (2)	1 (3)
Solubility						
NON-TEXTILE USAGE						
REACTIONS						
NOTES						

32	33	34	C.I. Mordant Violet
	Triphenylmethane		CHEMICAL CLASS
	43870		C.I. CONSTITUTION NUMBER
Dull Violet Redder	Dull Bluish Violet Much redder	Bright Reddish Violet Redder	HUE: Daylight Artificial light (tungsten)
1, 2 Afterchrome and Metachrome: Acetate and Cellulose—*u*, Silk—*ss*	1 Acetate—*ss* Cellulose—*u*	1 Acetate and Cellulose—*ss*	DYEING: WOOL Staining other fibres
	Silk: Afterchrome	Silk: Afterchrome	DYEING: OTHER FIBRES
	Wool: Chromium acetate	Wool, Silk and Cotton: Cr mordant	PRINTING

32		33		34			FASTNESS PROPERTIES ETC.
ISO		ISO		ISO			
Wool (1)	Wool (2)	Wool	Silk	Wool	Silk*	Cotton	
5	5	4	—	4–5	—	—	Method
–/4–5	–/4–5	—	—	5/4	4/4–5	—	Substrate
4–5	4–5	4–5	—	4–5	—	—	Alkali
—	4	—	—	4	—	2–3†	Cross Dyeing Wool Acetic/Sulphuric
4–5	4–5	5	—	5	—	—	Carbonising
							Chlorination
3	3	5	3–4	4	3–4	—	Decatising
5–6	5–6	3	—	3	2	1	Hot Pressing
6	6	4	3	3–4	2–3	1–2	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
6–7	6–7	4	—	4	3	2	normal
5	5	4	4	5	2–3	—	2× normal
3–4	3–4	4	—	4–5	—	—	Milling: Alkaline
—	4–5	1–2	1	1	3–4	—	Acid
5	5	5	5	5	3	—	Peroxide Bleaching
5	4	5	—	4–5	—	—	Perspiration
							Potting
—	5	5	—	5	—	—	Sea Water
4–5	4–5	4–5	4	3–4	3	—	Stoving
5	5	4–5	5	5	5	2	Washing
—	5	5	5	5	5	—	Water
4–5		—		3–4			Dischargeability
3–4 (1)	4 (2)	Unaltered		Slightly redder			Metal in dyebath: Copper
1 (1)	4 (2)	Somewhat duller		Duller			Iron
—		—		Very good			Solubility
		Wool and fur for hats, borax clearing 5					NON-TEXTILE USAGE
							REACTIONS
				*Printed †Chlorine			NOTES

C.I. Mordant Violet	35	36	37
CHEMICAL CLASS	Oxazine	Triphenylmethane	Monoazo
C.I. CONSTITUTION NUMBER	51025	43552	—
HUE: Daylight	Reddish Violet	Violet	Reddish Violet
Artificial light (tungsten)	Very little change	Redder	Much redder, brownish
DYEING: WOOL	3	1	1, 2, 3
Staining other fibres			Metachrome: Acetate and Cellulose—*ss*, Silk —*hs*
DYEING: OTHER FIBRES	Cotton: Al- or Fe-tannin mordant	Silk	
PRINTING	Wool and Cotton: Cr mordant Discharged white by chlorate and yellow prussiate on cotton	Wool and Silk: Chromium acetate Cotton: Chromium acetate, Chromate, dyeing on discharged Cr mordant Fastness to washing of wool prints 5	Wool and Silk: Chromium acetate
FASTNESS PROPERTIES ETC.			
Method		ISO	ISO
Substrate		Silk (dyed) / Cotton	Wool (2)*
Alkali		— / —	4–5
Cross Dyeing Wool Acetic/Sulphuric		— / —	—
Carbonising		— / —	4
Chlorination		— / 2*	5
Decatising		— / —	5
Hot Pressing		4 / —	4
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal		— / —	6–7
normal		3 / 2	6–7
2× normal		— / —	7
Milling: Alkaline		2 / —	4–5
Acid		— / —	5
Peroxide Bleaching		1 / —	4–5
Perspiration		5 / —	5
Potting		— / —	4
Sea Water		— / —	5
Stoving		2 / —	5
Washing		4 / 4	5
Water		5 / —	5
Dischargeability		Dischargeable to white	Unsuitable
Metal in dyebath: Copper		—	2 (1), 3–4 (2)
Iron		—	1 (1), 4 (2)
Solubility		—	—
NON-TEXTILE USAGE			
REACTIONS			
NOTES		*Chlorine	*Wool (1) similar

38	39	40	C.I. Mordant Violet
	Triphenylmethane	Monoazo	CHEMICAL CLASS
	43810	14745	C.I. CONSTITUTION NUMBER
Dull Bluish Violet	Reddish Violet	Dull Violet	HUE: Daylight
Little change	Slightly redder	Redder	Artificial light (tungsten)
		1, 2	DYEING: WOOL
		Afterchrome: Acetate and Silk—*hs*, Cellulose—*u*	Staining other fibres
Cotton: Pad with chromium acetate	Cotton: Pad with chromium acetate	Nylon: Afterchrome (medium substantivity)	DYEING: OTHER FIBRES
Wool and Silk: Chromium acetate Cotton: Chromium mordant	Wool and Silk: Chromium lactate + urea + glycerin Cotton: Chromium acetate mordant Acetate: Chromate	Wool: Chromium acetate Vigoureux printing	PRINTING
			FASTNESS PROPERTIES ETC.
ISO Printed Cotton	ISO Cotton	ISO Wool (1)	Method
—	—	5	Substrate
—	—	2–3/1	Alkali
—	—	5	Cross Dyeing Wool Acetic/Sulphuric
3*	3–4*	3–4	Carbonising
—	—	5	Chlorination
			Decatising
—	—	4	Hot Pressing
4–5	1–2	5	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
5–6	2–3	6	normal
6	3	6–7	2× normal
—	—	4	Milling: Alkaline
—	—	—	Acid
—	—	2–3	Peroxide Bleaching
—	—	5	Perspiration
—	—	3	Potting
—	—	5	Sea Water
—	—	5	Stoving
5 (40°C), 3 (100°C)	4–5 (40°C), 3 (100°C)	5	Washing
—	—	5	Water
Not dischargeable	Not dischargeable	Dischargeable to white	Dischargeability
—	—	Somewhat redder	Metal in dyebath: Copper
—	—	Destroyed	Iron
			Solubility
	Biological stain		NON-TEXTILE USAGE
			REACTIONS
*Chlorine	*Chlorine		NOTES

C.I. Mordant Violet	41	42	43
CHEMICAL CLASS	Monoazo	Disazo	Azo
C.I. CONSTITUTION NUMBER	**14220**		
HUE: Daylight	Bluish Violet	Bluish Violet	Bright Bluish Violet
Artificial light (tungsten)	Redder	Little change	Little change
DYEING: WOOL	1		
Staining other fibres			
DYEING: OTHER FIBRES		Cotton: Pad with chromium acetate	Cotton: Pad with chromium acetate
PRINTING		Wool and Silk: Chromium lactate Cotton: Chromium acetate mordant	Wool and Silk: Chromium lactate Cotton: Chromium acetate mordant
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Wool	Cotton	Cotton
Alkali	4–5	—	—
Cross Dyeing Wool Acetic/Sulphuric	2–3/3	—	—
Carbonising	4	—	—
Chlorination	—	4*	4*
Decatising	4	—	—
Hot Pressing	4–5	—	—
Light: ⅓–½ normal	—	1	1–2
normal	6–7	2	2
2× normal	—	2–3	3
Milling: Alkaline	4	—	—
Acid	3	—	—
Peroxide Bleaching	2	—	—
Perspiration	4–5	—	—
Potting	2	—	—
Sea Water	4–5	—	—
Stoving	—	—	—
Washing	4–5	3 (40°C) 2 (100°C)	4–5 (40°C) 3 (100°C)
Water	5	—	—
Dischargeability	—	Not dischargeable	Not dischargeable
Metal in dyebath: Copper	4	—	—
Iron	4	—	—
Solubility	—	—	—
NON-TEXTILE USAGE			
REACTIONS			
NOTES		*Chlorine	*Chlorine

44	45	46	C.I. Mordant Violet
Monoazo		Monoazo	CHEMICAL CLASS
14750		14740	C.I. CONSTITUTION NUMBER
Dull Bluish Violet	Dull Violet	Bright Reddish Violet	HUE: Daylight
Redder	Unaltered	Redder	Artificial light (tungsten)
1, 3	1, 3	1	DYEING: WOOL
Afterchrome: Acetate and Cellulose—*u*, Silk—*ss*	Afterchrome: Acetate and Silk—*ss*, Cellulose—*u*	Acetate and Cellulose—*u*, Silk—*ss*	Staining other fibres
			DYEING: OTHER FIBRES
Vigoureux printing		Wool: Chromium acetate	PRINTING
ISO	ISO	ISO	FASTNESS PROPERTIES ETC.
Wool (1)	Wool (1)	Wool (1)	Method
5	5	3–4	Substrate
—	–/2–3	—	Alkali
5	4–5	5	Cross Dyeing Wool Acetic/Sulphuric
—	—	—	Carbonising
5	4–5	4	Chlorination
			Decatising
5	4–5	5	Hot Pressing
5–6	5–6	4–5	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
6	6	5	normal
6–7	6–7	5–6	2× normal
5	4–5	4	Milling: Alkaline
4	—	3	Acid
2–3	—	3	Peroxide Bleaching
4	4–5	5	Perspiration
3–4	3	3–4	Potting
5	4–5	5	Sea Water
4–5	4–5	4	Stoving
5	5	4–5	Washing
4–5	5	5	Water
Dischargeable to white	—	—	Dischargeability
Redder	3	Somewhat weaker	Metal in dyebath: Copper
Destroyed	1–2	Destroyed	Iron
—	Suitable for machine dyeing	—	Solubility
			NON-TEXTILE USAGE
			REACTIONS
			NOTES

C.I. Mordant Violet	47	48
CHEMICAL CLASS		Monoazo
C.I. CONSTITUTION NUMBER		
HUE: Daylight	Reddish Violet	Reddish Violet→Bordeaux
Artificial light (tungsten)	Redder	Redder
DYEING: WOOL	1	1, 2, 3
Staining other fibres	Acetate and Cotton—*u*, Silk—*ss*	Afterchrome: Acetate and Cellulose—*u*, Nylon—*hs*, Silk—*ss*
DYEING: OTHER FIBRES		
PRINTING		
FASTNESS PROPERTIES ETC.		
Method	ISO	ISO
Substrate	Wool	(Wool (1)
Alkali	4–5	5
Cross Dyeing Wool Acetic/Sulphuric	–/3–4	—
Carbonising	4	5
Chlorination	—	—
Decatising	5	5
Hot Pressing	4	5
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	5–6	—
normal	6	8
2× normal	6–7	—
Milling: Alkaline	4	4–5
Acid	2	—
Peroxide Bleaching	—	4–5
Perspiration	5	4–5
Potting	4–5	5
Sea Water	—	4–5
Stoving	5	5
Washing	4	5
Water	—	—
Dischargeability	3	—
Metal in dyebath: Copper	4	Slightly redder
Iron	1	Slightly yellower
Solubility	—	Soluble in cold and hot water
NON-TEXTILE USAGE		
REACTIONS		In substance: H_2SO_4 conc.—reddish violet, on diln—violet ppt.
NOTES		

49	50	C.I. Mordant Violet
Triphenylmethane	Oxazine	CHEMICAL CLASS
	*	C.I. CONSTITUTION NUMBER
Bluish Violet Redder	Bright Reddish Violet Redder and duller	HUE: Daylight Artificial light (tungsten)
1, 2, 3 Afterchrome: Acetate and Cellulose—*vss*, Silk—*d*		DYEING: WOOL Staining other fibres
	Cotton: Pad with chromium acetate	DYEING: OTHER FIBRES
	Wool and Silk: Chromium lactate Cotton: Chromium acetate Used as an illuminating colour in discharges	PRINTING
ISO Wool 3 — 3–4 — 5 4–5 3–4 4 4–5 4–5 — — 5 4–5 5 3–4 5 — — — — Soluble in hot water	ISO Cotton — — — 4† — — 4–5 5 6 — — — — — — — 4–5 (40°C). 3 (100°C) — Not dischargeable — — —	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
		NON-TEXTILE USAGE
In substance: H_2SO_4 conc.—pale reddish orange, on diln—reddish blue; On wool: HNO_3 conc.—dull reddish yellow spot, greenish rim		REACTIONS
	*Similar to C.I. 51055 †Chlorine	NOTES

C.I. Mordant Violet	51	52	53
CHEMICAL CLASS		Azo	Azo
C.I. CONSTITUTION NUMBER			
HUE: Daylight	Bright Reddish Violet	Bright Reddish Violet	Reddish Violet
Artificial light (tungsten)	Little change	Little change	Redder
DYEING: WOOL			1
Staining other fibres			Acetate and Cotton—*u*, silk—*ss*
DYEING: OTHER FIBRES	Cotton: Pad with chromium acetate	Cotton: Pad with chromium acetate	
PRINTING	Wool and Silk: Chromium lactate Cotton: Chromium acetate mordant	Wool and Silk: Chromium lactate Cotton: Chromium acetate mordant	Wool: Chromium acetate, Chromate Vigoureux printing
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Cotton	Cotton	Wool (1)
Alkali	—	—	5
Cross Dyeing Wool Acetic/Sulphuric	—	—	–/3–4
Carbonising	—	—	5
Chlorination	4*	4*	—
Decatising	—	—	5
Hot Pressing	—	—	4
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	2–3	1–2	5
normal	3	1–2	6
2× normal	3–4	2	6–7
Milling: Alkaline	—	—	5
Acid	—	—	1
Peroxide Bleaching	—	—	—
Perspiration	—	—	5
Potting	—	—	3–4
Sea Water	—	—	—
Stoving	—	—	5
Washing	4–5 (40°C), 3 (100°C)	4 (40°C), 2–3 (100°C)	4–5*
Water	—	—	—
Dischargeability	Dischargeable to white	Not dischargeable	—
Metal in dyebath: Copper	—	—	3
Iron	—	—	1
Solubility	—	—	—
NON-TEXTILE USAGE			
REACTIONS			
NOTES	*Chlorine	*Chlorine	*Printed wool 5

54	55	56	C.I. Mordant Violet
Oxazine	Oxazine	Azo	CHEMICAL CLASS
51040	51090		C.I. CONSTITUTION NUMBER
Dull Bluish Violet Much redder and duller	Dull Bluish Violet Little change	Bright Bluish Violet Little change	HUE: Daylight Artificial light (tungsten)
			DYEING: WOOL Staining other fibres
Cotton: Pad with chromium acetate	Cotton: Pad with chromium acetate	Silk: Chromium lactate Cotton: Pad with chromium acetate	DYEING: OTHER FIBRES
Wool and Silk: Chromium lactate Cotton: Chromium acetate mordant Used in coloured discharges	Wool and Silk: Chromium lactate Cotton: Chromium acetate mordant	Wool and Silk: Cr lactate. Cotton: Chromium acetate mordant. Dyeing discharged grounds on unweighted silk	PRINTING
ISO Cotton — — — 4* — — 4 5 5–6 — — — — — — — 4 (40°C), 3 (100°C) — Not dischargeable — — —	ISO Printed Cotton — — — 3–4* — — 4 4–5 5–6 — — — — — — — 4 (40°C), 3 (100°C) — Not dischargeable — — —	ISO Cotton — — — 3–4* — — 3–4 4 4 — — — — — — — † — Dischargeable to white — — —	Silk — — — — — — 3–4 4 4–5 — — — 4 — — — 4–5 — 	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
See Leather Dyes section Biological stain			NON-TEXTILE USAGE
			REACTIONS
*Chlorine	*Chlorine	*Chlorine †4–5 (40°C), 3–4 (100°C)	NOTES

C.I. Mordant Violet	57	58
CHEMICAL CLASS	Azo	Oxazine
C.I. CONSTITUTION NUMBER		51165
HUE: Daylight	Bright Violet	Dull Violet
Artificial light (tungsten)	Little change	Little change
DYEING: WOOL		
Staining other fibres		
DYEING: OTHER FIBRES	Cotton: Pad with chromium acetate	Cotton: Pad with chromium acetate
PRINTING	Wool and Silk: Chromium lactate	Wool and Silk: Chromium lactate Cotton: Chromium acetate mordant Suitable in coloured discharges
FASTNESS PROPERTIES ETC.		
Method	ISO	ISO
Substrate	Cotton	Cotton
Alkali	—	—
Cross Dyeing Wool Acetic/Sulphuric	—	—
Carbonising	—	—
Chlorination	3–4*	3*
Decatising	—	—
Hot Pressing	—	—
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	3	4–5
normal	3–4	5–6
2× normal	4	6–7
Milling: Alkaline	—	—
Acid	—	—
Peroxide Bleaching	—	—
Perspiration	—	—
Potting	—	—
Sea Water	—	4–5 (40°C), 3 (100°C)
Stoving	—	—
Washing	4–5 (40°C), 3–4 (100°C)	—
Water	—	—
Dischargeability	Dischargeable to white	Not dischargeable
Metal in dyebath: Copper		
Iron		
Solubility		
NON-TEXTILE USAGE		
REACTIONS		
NOTES	*Chlorine	*Chlorine

59	60	C.I. Mordant Violet
		CHEMICAL CLASS C.I. CONSTITUTION NUMBER
Bright Reddish Violet	Bright Violet	HUE: Daylight Artificial light (tungsten)
		DYEING: WOOL Staining other fibres
		DYEING: OTHER FIBRES
		PRINTING
		FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: ⅓–½ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
Anodised aluminium—Fastness: Light 7; Weather, fairly good to good; Heat (*a*) 6 h at 200°C deeper; (*b*) 1 h at 250°C deeper	Anodised aluminium—Fastness: Light 6–7; Weather, good; Heat (*a*) 6 h at 200°C good; (*b*) 1 h at 250°C good	NON-TEXTILE USAGE
		REACTIONS
		NOTES

C.I. Mordant Violet	61	62
CHEMICAL CLASS C.I. CONSTITUTION NUMBER		
HUE: Daylight Artificial light (tungsten)	Bright Violet	Bright Bluish Violet
DYEING: WOOL Staining other fibres		
DYEING: OTHER FIBRES		
PRINTING		
FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: ½–½ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility		
NON-TEXTILE USAGE	Anodised aluminium—Fastness: Light 7; Weather, moderate; Heat (*a*) 6 h at 200°C weaker; (*b*) 1 h at 250°C much weaker	Anodised aluminium—Fastness: Light 7; Weather, very good; Heat (*a*) 6 h at 200°C weaker; (*b*) 1 h at 250°C much weaker
REACTIONS		
NOTES		

C.I. Mordant Blue	1	2
CHEMICAL CLASS	Triphenylmethane	Azo
C.I. CONSTITUTION NUMBER	43830	
HUE: Daylight	Bright Blue→Reddish Navy	Reddish Navy
Artificial light (tungsten)	Slightly redder	Somewhat redder
DYEING: WOOL	—	1
Staining other fibres	Afterchrome: Acetate—*vss–hs*, Cellulose—*u–ss* Metachrome: Acetate and Cellulose—*u–ss* Mordant: Acetate—*ss*, Cotton—*vss*	Acetate and Cotton—*u*, Silk—*ss*
DYEING: OTHER FIBRES	Silk: Afterchrome Nylon: Afterchrome (high substantivity)	
PRINTING	Wool: Chromium acetate Silk and Cotton: Chromate Vigoureux printing	Wool: Chromium fluoride Vigoureux printing
FASTNESS PROPERTIES ETC.		
Method	AATCC	ISO
Substrate	Wool (1)	Wool (1)*
Alkali	4	4
Cross Dyeing Wool Acetic/Sulphuric	5/5	5/4–5
Carbonising	4	3
Chlorination	—	5
Decatising	4–5	5
Hot Pressing	4–5	5
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	2	3
normal	4	4
2× normal	5	4–5
Milling: Alkaline	5	4
Acid	—	3
Peroxide Bleaching	5	1–2
Perspiration	5	5
Potting	4–5	5
Sea Water	5	5
Stoving	5	4
Washing	5	5
Water	5	5
Dischargeability	Dischargeable to white	
Metal in dyebath: Copper	Slight change	
Iron	Somewhat duller	
Solubility	Very good	

ISO
Wool
4–5
–/3–4
4
—
5
5
6
6–7
7
4–5
2
4–5
—
4
—
4–5
4
—
4–5
3–4
2
—

NON-TEXTILE USAGE	Barium salt is used as a pigment in book and lithographic inks. Biological stain See Leather Dyes section Loose wool and fur for hats, borax clearing 5	
REACTIONS		
NOTES	*Wool (2) very similar and Wool (3) similar	

C.I. Mordant Blue	3	4	5
CHEMICAL CLASS	Triphenylmethane	Monoazo	
C.I. CONSTITUTION NUMBER	**43820**	**15695**	
HUE: Daylight	Bright Reddish Blue	Dull Reddish Navy	
Artificial light (tungsten)	Much redder	Little change	
DYEING: WOOL	1, 2, 3	1, 2	This C.I. Generic Name is discontinued, dyes formerly listed under it now appear under C.I. Mordant Black 17
Staining other fibres	Afterchrome: Acetate and Cotton—*u–hs*, Viscose—*u–ss* Mordant: Acetate and Cellulose—*ss*	Afterchrome: Acetate and Silk—*ss*, Cellulose—*u*	
DYEING: OTHER FIBRES	Nylon: Afterchrome (medium substantivity)		
PRINTING	Wool, Silk and Cotton: Chromium mordant	Wool: Chromium acetate	
FASTNESS PROPERTIES ETC.			
Method	AATCC / ISO	ISO	
Substrate	Wool (1) / Wool (1) and (2)	Wool (1)	
Alkali	3 / 5	5	
Cross Dyeing Wool Acetic/Sulphuric	4–5/4 / —	—	
Carbonising	3 / 5	5	
Chlorination	— / —	—	
Decatising	5 / 5	4–5	
Hot Pressing	— / 5	4	
Light: ½–½ normal	2 / 5	—	
normal	4 / 6	6	
2× normal	6 / 7	—	
Milling: Alkaline	4 / 4	5	
Acid	— / —	2–3	
Peroxide Bleaching	1 / —	3–4	
Perspiration	5 / 5	4–5	
Potting	4–5 / 5	2–3	
Sea Water	5 / 5	3–4	
Stoving	4–5 / 5	4–5	
Washing	5 / 5	5	
Water	5 / 5	5	
Dischargeability	Dischargeable to white	Dischargeable to white	
Metal in dyebath: Copper	Redder 3	Violet	
Iron	Browner 1	Olive brown	
Solubility	—	—	
NON-TEXTILE USAGE	Indicator Microscopic stain See Leather Dyes section		
REACTIONS	On wool: NHO_3 conc.—dirty yellow spot turning yellow and with a pale rim		
NOTES			

6	7	8	C.I. Mordant Blue
Disazo	Monoazo	Anthraquinone	CHEMICAL CLASS
21590	17940	58805	C.I. CONSTITUTION NUMBER
Navy	Reddish Navy	Navy	HUE: Daylight
Redder	Redder	Little change	Artificial light (tungsten)
1 Acetate, Cotton and Silk—*ss*, Viscose—*u*	1, 2 Afterchrome: Acetate—*ss–s*, Cotton—*u–vss*, Silk—*ss–hs*, Viscose—*u* Metachrome: Acetate—*u–s*, Cotton—*ss–s*, Silk—*hs*, Viscose—*u–s*	1, 3 Mordant: Acetate and Cellulose—*hs*, Silk—*d*	DYEING: WOOL Staining other fibres
	Nylon: Afterchrome (high substantivity)		DYEING: OTHER FIBRES
	Wool: Cr mordant Vigoureux printing	Wool: Cr mordant	PRINTING

ISO	ISO		AATCC	ISO		FASTNESS PROPERTIES ETC.
Wool (1)	Wool (1)	Wool (2)	Wool (3)	Wool (2)	Wool (3)	Method
5	5	4–5	2–3	3	3	Substrate
–/4	–/4–5	–/4–5	—	–/2–3	—	Alkali
4	4–5	4	3	3	3	Cross Dyeing Wool Acetic/Sulphuric
—	4	4	—	4	5	Carbonising
4	4–5	4	—	3	5	Chlorination
						Decatising
5	5	4	—	—	—	
—	6	6	—	—	3	Hot Pressing
6	7	7	6–7	6–7	3–4	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
—	7–8	7–8	—	—	4	normal
5	5	4–5	3	4	3	2× normal
—	4–5	4	—	—	—	Milling: Alkaline
—	4	3	—	1	—	Acid
5	5	5	3	—	4–5	Peroxide Bleaching
5	4–5	4	—	3	2	Perspiration
						Potting
5	5	5	2–3	4–5	5	
4	5	4	—	4	4–5	Sea Water
5	5	4–5	3	4–5	3	Stoving
5	5	5	—	5	—	Washing
						Water
—	2–3			—		
1	Somewhat redder (1), 3–4 (2)			5		Dischargeability
—	Destroyed brown (1), 4 (2)			4		Metal in dyebath: Copper
—	Suitable for package dyeing			—		Iron
						Solubility

	See Leather Dyes section		NON-TEXTILE USAGE
		On wool: HNO_3 conc.—dull greenish yellow	REACTIONS
			NOTES

C.I. Mordant Blue	9	10	11
CHEMICAL CLASS	Monoazo	Oxazine	
C.I. CONSTITUTION NUMBER	**14855**	**51030**	
HUE: Daylight	Reddish Navy	Reddish Navy	
Artificial light (tungsten)	Slightly redder	Little change	
DYEING: WOOL	1, 3	3	This C.I. Generic Name is discontinued, dyes formerly appearing under it now appear under C.I. Mordant Black 3
Staining other fibres	Afterchrome: Acetate and Cellulose—*u*	Acetate and Cellulose—*hs*, Nylon—*ss*	
DYEING: OTHER FIBRES	Silk: Mordant Nylon: Afterchrome	Cotton: Pad with chromium acetate	
PRINTING	Wool: Cr mordant Vigoureux printing	Wool, Silk and Cotton: Cr mordant Used in coloured discharges	

FASTNESS PROPERTIES ETC.

Method	AATCC	ISO		ISO	
Substrate	Wool (1)	Wool (1)*	Silk	Wool (3)	Cotton
Alkali	4–5	5	—	3–4	—
Cross Dyeing Wool Acetic/Sulphuric	—	4/1–2	2/2	—	—
Carbonising	4–5	4	—	5	—
Chlorination	—	4–5	—	—	3–4*
Decatising	4	5	—	—	—
Hot Pressing	4–5	5	3 (A), 3 (B)	4	—
Light: ⅛–½ normal	—	5–6	—	—	4–5
normal	7	6	6	6	5
2× normal	—	6–7	6–7	—	5–6
Milling: Alkaline	4	4	3–4	3–4	—
Acid	—	4	—	—	—
Peroxide Bleaching	1–2	2	1	—	—
Perspiration	4–5	4–5	3	5	—
Potting	4	3–4	—	3	—
Sea Water	4–5	5	—	5	—
Stoving	3–4	4	1–2	4	—
Washing	5	4–5	3–4	4	3–4
Water	—	4–5	5	—	—
Dischargeability	Dischargeable to white			—	
Metal in dyebath: Copper	Redder 2			Duller	
Iron	Dull bluish brown 1			Slightly duller	
Solubility	—			—	

NON-TEXTILE USAGE		Microscopic stain	
REACTIONS	On wool: HNO_3 conc.—bluish red; H_2SO_4 conc.—dark brown HCl conc.—dull violet		
NOTES	*Wool (2) similar	*Chlorine	

12	13	13:1	C.I. Mordant Blue
Monoazo	Monoazo 16680	Monoazo	CHEMICAL CLASS C.I. CONSTITUTION NUMBER
Reddish Blue Redder	Navy Slightly duller and redder	Navy Slightly duller and redder	HUE: Daylight Artificial light (tungsten)
1, 2 Afterchrome: Acetate and Cellulose—*ss*, Nylon—*s*, Silk—*hs* Metachrome: Acetate and Silk—*ss*, Cellulose—*u*	1, 2, 3 Afterchrome: Acetate—*u–s*, Cellulose—*u–ss*	Slightly different chemically from but similar in properties and usage to C.I. Mordant Blue 13	DYEING: WOOL Staining other fibres
	Silk: Afterchrome Nylon: Afterchrome (low substantivity)		DYEING: OTHER FIBRES
	Vigoureux printing		PRINTING
AATCC Wool (2) / ISO Wool (2) 4–5 / 5 — / 2–3* 5 / 4 3–4 / 4 4 / 4 4–5 / 4–5 — / — 6–7 / 7–8 7–8 / 8 4–5 / 4–5 — / — 4 / 4 5 / 5 4 / 4 5 / 5 4–5 / 4–5 5 / 5 — / 5 — Slight change Slight change —	AATCC Wool (1) / ISO Wool (1)* 3–4 / 4–5 5/4 / 4/3–4 5 / 4–5 — / 4–5 5 / 5 4 / 4–5 5 / — 6 / 6–7 7 / 7 3 / 4 — / 4 2 / 3–4 5 / 5 5 / 5 5 / 5 5 / 4 4 / 5 5 / 5 Not dischargeable Much redder Destroyed Very good		FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: ⅓–½ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
	Anodised aluminium		NON-TEXTILE USAGE
In substance: H_2SO_4 conc. —very reddish blue, on diln —reddish brown			REACTIONS
*Bisulphate	*Wool (3) similar but wet fastness properties lower		NOTES

C.I. Mordant Blue	14	15	16
CHEMICAL CLASS	Oxazine	Monoazo	
C.I. CONSTITUTION NUMBER	51050		
HUE: Daylight	Reddish Navy	Reddish Navy	Reddish Navy
Artificial light (tungsten)	Little change	Duller and much redder	Slightly redder
DYEING: WOOL	3	2	1
Staining other fibres	Acetate, Cotton and Silk—*s*, Viscose—*hs*	Acetate and Cellulose—*ss*, Silk—*hs*	Acetate and Cellulose—*s*, Nylon and Silk—*hs*
DYEING: OTHER FIBRES	Cotton: Pad with chromium acetate		
PRINTING	Wool, Silk and Cotton: Cr mordant Used in coloured discharges		Wool: Cr mordant
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Wool (3)	Wool (2)	Wool (1)
Alkali	5	5	5
Cross Dyeing Wool Acetic/Sulphuric	—	—	5
Carbonising	5	5	4
Chlorination	—	5	—
Decatising	3	5	5
Hot Pressing	5	4–5	5
Light: ⅛–½ normal	—	5–6	6
normal	5	6	7
2× normal	—	7	7–8
Milling: Alkaline	3–4	4–5	5
Acid	—	5	—
Peroxide Bleaching	3	4	4
Perspiration	5	5	5
Potting	1–2	4	5
Sea Water	3	5	5
Stoving	4	5	5
Washing	4	5	5
Water	3	5	5
Dischargeability	Not dischargeable	Unsuitable	—
Metal in dyebath: Copper	Unaltered	2	Slightly redder
Iron	Destroyed	5	Destroyed, brown
Solubility	—	Good	Very good
NON-TEXTILE USAGE	Biological stain		
REACTIONS			
NOTES			

17	18	19	C.I. Mordant Blue
	Monoazo 18090	Monoazo	CHEMICAL CLASS C.I. CONSTITUTION NUMBER
Reddish Navy Redder	Reddish Navy Duller	Reddish Navy Greener and duller	HUE: Daylight Artificial light (tungsten)
	1 Acetate—*ss–s* Cellulose—*u–ss*	1, 3 Afterchrome: Acetate, Nylon and Silk—*d*, Cellulose—*hs*	DYEING: WOOL Staining other fibres
			DYEING: OTHER FIBRES
Wool, Silk and Cotton: Cr mordant			PRINTING
ISO Cotton — — — 4* — — — 2–3 — — — — — — — 4–5 — 2–3 — — —	ISO Wool (1) 4–5 — — — 5 4–5 — 5–6 — 4–5 — — 5 — 5 4–5 5 5 — — — —	AATCC Wool (1) 5 — 4–5 — 5 5 — 6–7 — 5 — 3–4 5 4 5 4 5 5 — Unaffected Slightly duller and redder Soluble in cold and hot water	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
			NON-TEXTILE USAGE
		In substance: H_2SO_4 conc.—reddish violet, on diln—red ppt. On wool: H_2SO_4 conc.—brown	REACTIONS
*Chlorine			NOTES

C.I. Mordant Blue	20	21
CHEMICAL CLASS	Monoazo	Monoazo
C.I. CONSTITUTION NUMBER		
HUE: Daylight	Reddish Navy	Reddish Navy
Artificial light (tungsten)	Redder	Weaker and slightly redder
DYEING: WOOL	1, 2	1, 2, 3
Staining other fibres	Metachrome: Acetate and Cellulose—*ss*, Nylon and Silk—*hs*	Metachrome: Acetate and Cellulose—*ss*, Silk—*hs*
DYEING: OTHER FIBRES		
PRINTING		
FASTNESS PROPERTIES ETC.		
Method	AATCC	ISO
Substrate	Wool (1)	Wool (2)* / Silk
Alkali	4	4 / —
Cross Dyeing Wool Acetic/Sulphuric	—	3–4/2 / 3/2
Carbonising	4	4 / —
Chlorination	—	4 / —
Decatising	4	4 / —
Hot Pressing	4	4–5 / 4–5
Light: ⅓–½ normal	—	6–7 / 6–7
normal	8	7 / 7
2× normal	—	8 / 8
Milling: Alkaline	5	4–5 / 4
Acid	—	2 / —
Peroxide Bleaching	2	3 / 1
Perspiration	5	5 / 4
Potting	4	4 / —
Sea Water	5	5 / —
Stoving	—	4–5 / 4
Washing	5	5 / 4–5
Water	—	5 / 4–5
Dischargeability	—	Dischargeable to white
Metal in dyebath: Copper	Much redder	3
Iron	Considerably redder and duller	3
Solubility	—	Sparingly sol. in cold and sol. in hot water
NON-TEXTILE USAGE		
REACTIONS	In substance: H_2SO_4 conc.—reddish violet, on diln—dull yellow ppt. On wool: HNO_3 conc.—black	On wool: H_2SO_4 conc.—bordeaux; HCl conc.—violet; HNO_3 conc.—dark brown
NOTES		*Wool (1) and (3) very similar

22	23	24	C.I. Mordant Blue
	Anthraquinone	Anthraquinone	CHEMICAL CLASS
	58610	60880	C.I. CONSTITUTION NUMBER
Reddish Blue Redder	Reddish Navy Little change	Reddish Navy Little change	HUE: Daylight Artificial light (tungsten)
1 Acetate—*ss* Cellulose—*u* Silk—*hs*	1 Acetate and Cellulose—*ss*, Silk—*hs*	3 Acetate, Cellulose and Silk—*ss*	DYEING: WOOL Staining other fibres
			DYEING: OTHER FIBRES
	Wool: Cr mordant		PRINTING
ISO Wool (1) 5 –/2–3 5 — 5 4–5 5–6 6–7 7–8 5 — 2–3 5 4 5 4–5 5 5 — 3 1 —	AATCC Wool (3) 3 — 3 — — — — 7 — 3 — — 5 — 4–5 — 4 — Not dischargeable to white — — —	ISO Wool (3) 4 — 3–4 — 4 5 — 6–7 — 4 4 1 3 2 3 4 4 3 Not dischargeable to white Unchanged Weaker —	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
	Microscopic stain		NON-TEXTILE USAGE
			REACTIONS
			NOTES

C.I. Mordant Blue	25	26	27
CHEMICAL CLASS	Monoazo	Azo	Anthraquinone
C.I. CONSTITUTION NUMBER	*		67415
HUE: Daylight	Reddish Navy	Reddish Navy	Reddish Navy (wool) Greenish Navy (cotton)
Artificial light (tungsten)	Redder	Duller	Somewhat greener
DYEING: WOOL	1	1, 2, 3	3
Staining other fibres	Acetate—*s–hs* Cotton—*u–ss* Viscose—*ss*	Metachrome: Acetate and Cellulose—*ss*, Nylon—*hs*, Silk—*ss–s*	Acetate, Cellulose and Silk—*ss*
DYEING: OTHER FIBRES			Silk: Al or Cr mordant Cotton: Cr or Fe mordant
PRINTING			

FASTNESS PROPERTIES ETC.						
Method	ISO	AATCC	ISO		ISO	
Substrate	Wool (1)	Wool (2)	Wool (2)	Wool (3)	Silk (Al)	Silk (Cr)
Alkali	5	4–5	4–5	2–3	—	—
Cross Dyeing Wool Acetic/Sulphuric	—	—	2–3*	–/4	–/3	–/4
Carbonising	4–5	4	4	4	—	—
Chlorination	—	3–4	3–4	—	—	—
Decatising	4–5	4	4	4	—	—
Hot Pressing	5	4–5	4–5	4	5	3
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	—	—	—	5	5	3
normal	5	6–7	7	5–6	5	3
2× normal	—	7–8	8	6	5–6	3–4
Milling: Alkaline	5	4–5	4–5	4–5	4	2–3
Acid	—	—	—	4	—	—
Peroxide Bleaching	—	4	3–4	3	4	3–4
Perspiration	4	5	5	4	5	5
Potting	—	4	3–4	4	—	—
Sea Water	5	5	5	5	—	—
Stoving	4	4–5	4–5	4–5	3–4	3–4
Washing	4–5	—	5	4–5	5	5
Water	5	—	5	5	5	5
Dischargeability	—	—		Not dischargeable		
Metal in dyebath: Copper	Much affected	Slight change		Somewhat duller		
Iron	—	Slight change		Much weaker		
Solubility	—	—		—		

NON-TEXTILE USAGE			Biological stain Indicator
REACTIONS		In substance: H_2SO_4 conc.—very reddish blue, on diln—reddish brown	
NOTES	*Preparation: 4-Chloro-2-aminophenol→amino-naphthol sulphonic acid	*Bisulphate	Fastness on cotton (ISO): Chlorine 4; Light 4, 4–5, 5; Washing 3–4

28	29	30	C.I. Mordant Blue
Triphenylmethane 44535	Triphenylmethane 43825	Azo	CHEMICAL CLASS C.I. CONSTITUTION NUMBER
Bright Blue→Reddish Navy Slightly redder	Reddish Blue Redder	Reddish Navy Redder	HUE: Daylight Artificial light (tungsten)
1, 2, 3 Afterchrome: Acetate and Cellulose—*u* Metachrome: Acetate—*ss*, Cellulose—*u*	3	1, 2, 3 Afterchrome: Acetate, Cotton and Silk—*hs*, Viscose—*u* Metachrome: Acetate and Silk—*hs*, Cotton—*ss*, Viscose—*u*	DYEING: WOOL Staining other fibres
Silk: Cr mordant in broken soap bath Nylon: Afterchrome, 90 min. boil	Silk: Afterchrome Cotton: Pad with chromate		DYEING: OTHER FIBRES
Wool: Cr mordant	Wool, Silk and Cotton: Chromium acetate, Chromate Vigoureux printing		PRINTING
ISO Wool (1) and (2)* — 5/4–5 3 5 5 5 3 4 4–5 4 3 1–2 5 5 5 4 5 5 Not dischargeable 4 4 —	ISO Wool (3) Silk (1) 2–3 — 4/3–4 — 4 — 1 — 3 — 4 5 2 — 3 3 3–4 — 4 3–4 2 — 2 2 4–5 5 3–4 — 4–5 — 4–5 5 4 5 5 5 5 Slightly duller Much duller —	ISO Wool (2)* 5 5/4 5 5 5 5 — 7 7–8 4–5 4 4–5 5 4 5 5 5 5 Unsuitable 2 (1), 2–3 (2), 2 (3) 1 (1), 2–3 (2), 1 (3) Moderate	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
	Biological stain	*Wool (1) and (3) similar	NON-TEXTILE USAGE
			REACTIONS
*Wool (3) very similar but fastness to decatising and alk. milling somewhat lower			NOTES

C.I. Mordant Blue	31	32	33
CHEMICAL CLASS	Monoazo	Anthraquinone	Oxazine
C.I. CONSTITUTION NUMBER	16675	58605	
HUE: Daylight	Reddish Navy	Reddish Navy	Reddish Navy
Artificial light (tungsten)	Redder	Slightly duller	Little change
DYEING: WOOL	1, 2, 3	1	
Staining other fibres	Afterchrome: Acetate—*u–hs*, Cotton—*u–ss*, Silk—*hs*, Viscose—*ss*	Acetate, Cellulose and Silk—*hs*	
DYEING: OTHER FIBRES	Silk: Afterchrome		Cotton: Pad with chromium acetate
PRINTING	Wool: Cr mordant	Wool: Cr mordant Vigoureux printing	Wool and Silk: Chromium lactate Cotton: Chromium acetate mordant

FASTNESS PROPERTIES ETC.

	ISO		AATCC	ISO	ISO
Method					
Substrate	Wool (1)	Silk	Wool (3)	Wool (3)	Printed cotton
Alkali	4–5	—	5	3	—
Cross Dyeing Wool Acetic/Sulphuric	–/2	1/2–3	—	—	—
Carbonising	5	—	5	3	—
Chlorination	4–5	—	—	—	3–4*
Decatising	4–5	—	—	3	—
Hot Pressing	4–5	3	dry 3, wet 5	3–4	—
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	4–5	5	—	—	4–5
normal	5	6	8	6	5
2× normal	5–6	6–7	—	—	6
Milling: Alkaline	5	3–4	3	4	—
Acid	2–3	—	—	—	—
Peroxide Bleaching	2	2–3	1	1	—
Perspiration	4–5	4	5	5	—
Potting	2–3	—	3–4	3	—
Sea Water	4–5	—	5	4–5	—
Stoving	5	4–5	5	4	—
Washing	5	3–4	4	—	4 (40°C), 3 (100°C)
Water	5	4	—	5	—
Dischargeability	—		—		Not dischargeable
Metal in dyebath: Copper	2		Much altered		—
Iron	2		Destroyed		—
Solubility	—		—		—

NON-TEXTILE USAGE	Anodised aluminium	Biological stain Leather: On chrome and vegetable tannages	
REACTIONS			
NOTES			*Chlorine

34	35	36	C.I. Mordant Blue
	Oxazine	Oxazine	CHEMICAL CLASS
	51080	■	C.I. CONSTITUTION NUMBER
Reddish Navy	Greenish→Reddish Navy Little change		HUE: Daylight Artificial light (tungsten)
			DYEING: WOOL Staining other fibres
Cotton: Pad with chromium acetate	Cotton: Pad with chromium acetate	Cotton: Pad with chromium acetate	DYEING: OTHER FIBRES
Wool: Chromium lactate Cotton: Chromium acetate	Wool and Silk: Chromium lactate Cotton: Chromium acetate Illuminating colour in discharges	Wool and Silk: Chromium lactate Cotton: Chromium acetate	PRINTING
ISO Printed cotton — — — 3–4* — — 4 4–5 5 — — — — — — — 4 (40°C), 3–4 (100°C) — Dischargeable to white	ISO Printed cotton — — — 3–4* — — 4–5 5 5–6 — — — — — — — 4 (40°C), 3 (100°C) — Not dischargeable	ISO Printed cotton — — — 4† — — 4 5–6 6 — — — — — — — 5 (40°C), 3 (100°C) — Not dischargeable	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
			NON-TEXTILE USAGE
			REACTIONS
*Chlorine	*Chlorine	*Similar to C.I. 51055 †Chlorine	NOTES

C.I. Mordant Blue	37		38	39	
CHEMICAL CLASS	Azo				
C.I. CONSTITUTION NUMBER					
HUE: Daylight	Navy		Navy	Navy	
Artificial light (tungsten)	Little change		Much redder	Duller and redder	
DYEING: WOOL	1, 3		1	1, 2	
Staining other fibres	Afterchrome: Acetate and Cotton—*u*, Silk—*ss*		Acetate—*ss* Cellulose—*u* Silk—*hs*	Afterchrome: Acetate—*hs*, Cellulose and Silk—*ss* Metachrome: Acetate and Silk—*ss*, Cellulose—*hs*	
DYEING: OTHER FIBRES					
PRINTING					
FASTNESS PROPERTIES ETC.					
Method	AATCC	ISO	ISO	ISO	
Substrate	Wool (1)	Wool (1)	Wool (1)	Wool (1)	Wool (2)
Alkali	—	5	4	5	5
Cross Dyeing Wool Acetic/Sulphuric	—	–/3	—	2/1	2/1
Carbonising	4–5	5	4	4–5	4–5
Chlorination	4–5	—	—	3–4	3–4
Decatising	5	5	4–5	4	4
Hot Pressing	5	5	5	5	4–5
Light: ⅓–½ normal	—	4–5	—	—	—
normal	4	5	5	6–7	6–7
2× normal	—	6	—	7–8	7–8
Milling: Alkaline	4	4	4–5	5	4–5
Acid	—	2–3	—	—	—
Peroxide Bleaching	—	—	4	3–4	3–4
Perspiration	4–5	5	5	5	5
Potting	4–5	5	3–4	3–4	3–4
Sea Water	5	—	5	5	5
Stoving	—	5	4–5	4–5	4–5
Washing	—	3–4	4	5	5
Water	—	—	5	5	5
Dischargeability	3			—	
Metal in dyebath: Copper	3–4			Marked change (1) Slight change (2)	
Iron	2			Strong change (1) Slight change (2)	
Solubility	—			—	
NON-TEXTILE USAGE					
REACTIONS					
NOTES					

40	41	42	C.I. Mordant Blue
Azo	Azo	Triphenylmethane	CHEMICAL CLASS
		44100	C.I. CONSTITUTION NUMBER
Navy Much redder	Navy Redder	Bright Navy Slightly duller	HUE: Daylight Artificial light (tungsten)
1, 2 Afterchrome: Acetate, Cotton and Silk—*ss*, Viscose—*u* Metachrome: Acetate and Silk—*ss*, Cellulose—*hs*	1, 2, 3 Afterchrome: Acetate, Cotton and Silk—*hs*, Viscose—*u* Metachrome: Acetate, Cotton and Silk—*hs*, Viscose—*ss*	1 Acetate and Cellulose—*u*, Silk—*hs*	DYEING: WOOL Staining other fibres
	Silk: Afterchrome Nylon: Afterchrome, boil 90–120 min. for lake formation	Silk: Afterchrome	DYEING: OTHER FIBRES
		Wool, Silk and Cotton: Chromium acetate Dyeing on a discharged chrome mordant	PRINTING
ISO Wool (1) and (2)	ISO Wool (2)	ISO Wool (1) Silk	FASTNESS PROPERTIES ETC.
5	5	5 —	Method
2/1	4–5/4–5	— —	Substrate
4–5	4	5 —	Alkali
4	4–5	— —	Cross Dyeing Wool Acetic/Sulphuric
4	5	5 —	Carbonising
			Chlorination
			Decatising
5	5	4 4–5	Hot Pressing
—	—	— —	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
6–7	7	5–6 3	normal
7–8	7–8	— —	2× normal
5*	4–5	4 4	Milling: Alkaline
—	4	4 —	Acid
3–4	4–5	1 1	Peroxide Bleaching
5	5	5 5	Perspiration
4–5	4–5	4 —	Potting
5	5	5 —	Sea Water
4–5	4–5	5 5	Stoving
5	4–5	4 5	Washing
5	5	5 5	Water
—	Unsuitable for discharge work	—	Dischargeability
Marked change (1), Slight change (2)	2–3	Unaltered	Metal in dyebath: Copper
Strong change (1), Slight change (2)	2–3	Weaker	Iron
—	Fair	—	Solubility
			NON-TEXTILE USAGE
			REACTIONS
*Wool (2) 4–5			NOTES

C.I. Mordant Blue	43	44
CHEMICAL CLASS		Monoazo
C.I. CONSTITUTION NUMBER		17250
HUE: Daylight	Navy	Greenish Navy (Cr), Deep Blue (Cu)
Artificial light (tungsten)	Duller and redder	Somewhat greener (Cr), somewhat redder (Cu)
DYEING: WOOL	1, 2	1, Copper sulphate, 3
Staining other fibres	Afterchrome: Acetate and Viscose—*u*, Cotton and Silk—*ss* Metachrome: Acetate and Cellulose—*ss*, Silk—*hs*	Afterchrome: Acetate—*ss*, Cellulose—*u*, Silk—*ss–hs* Copper sulphate: Acetate—*ss*, Cellulose—*u–ss*, Silk—*ss–hs* Mordant: Acetate and Cellulose—*ss*, Silk—*hs*
DYEING: OTHER FIBRES		Nylon: Afterchrome (medium substantivity)
PRINTING		Wool: Cr mordant Vigoureux printing

FASTNESS PROPERTIES ETC.

Method	ISO		ISO		
Substrate	Wool (1)	Wool (2)	Wool (1)	Wool (aftercoppered)	Wool (3)
Alkali	5	5	3–4	3	3
Cross Dyeing Wool Acetic/Sulphuric	4–5/4	4–5/4	4–5/2	1/1	—
Carbonising	4–5	4–5	4–5	3–4	4
Chlorination	3	3	4	4	—
Decatising	4	4	4–5	4	3–4
Hot Pressing	5	5	3–4	4–5	3–4
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	—	—	—	—	—
normal	7	7	6	6–7	6
2× normal	8	8	7	7–8	—
Milling: Alkaline	4–5	4	4–5	4–5	4
Acid	—	—	—	—	—
Peroxide Bleaching	4	4	4	2–3	3
Perspiration	5	5	5	4	4
Potting	3–4	3	3–4	2	3–4
Sea Water	5	5	5	4	4–5
Stoving	4–5	4	4–5	4	4
Washing	5	5	5	3	3–4
Water	5	5	5	5	5
Dischargeability	—		—		
Metal in dyebath: Copper	Slight change (1), No change (2)		Slight change (1), Unaltered (Cu)		
Iron	Strong change (1), Slight change (2)		Much changed (1), Marked change (Cu)		
Solubility	—		Suitable for package dyeing		

NON-TEXTILE USAGE		
REACTIONS		
NOTES		

45	46	47	C.I. Mordant Blue
Oxazine	Oxazine	Triphenylmethane	CHEMICAL CLASS
51045	51155	43855	C.I. CONSTITUTION NUMBER
Reddish Blue→Navy	Blue	Bright Blue	**HUE:** Daylight
Slightly redder	No change	Greener	Artificial light (tungsten)
3	1, 3	1, 2, 3	**DYEING: WOOL**
		Afterchrome and Metachrome: Acetate and Cellulose—*ss*, Silk—*hs* Mordant: Acetate, Cotton and Silk—*ss*	Staining other fibres
			DYEING: OTHER FIBRES
Silk and Cotton: Cr mordant	Cotton: Cr mordant	Wool: Chromium acetate, Chromate Silk: Chromate	**PRINTING**
			FASTNESS PROPERTIES ETC.
ISO	—	AATCC ISO	Method
Cotton	Wool (3)*	Wool (1) Wool (1) Wool (2)*	Substrate
—	Moderate	— 5 4	Alkali
—	—	— — —	Cross Dyeing Wool Acetic/Sulphuric
—	—	4–5 4 4	Carbonising
5*	—	4–5 — 4–5	Chlorination
—	—	5 5 4	Decatising
—	—	4–5 4 4	Hot Pressing
—	—	— — —	Light: ⅓–½ normal
5	Moderate	3 5 5	normal
6	—	— — —	2× normal
—	Moderate*	4–5 5 3–4	Milling: Alkaline
—	—	— 4 4	Acid
—	—	— 2 3	Peroxide Bleaching
—	—	5 5 4	Perspiration
—	—	4–5 4 3–4	Potting
—	—	5 5 4–5	Sea Water
—	—	— 4–5 4–5	Stoving
4–5	Moderate	— 5 4	Washing
—	—	— 5 4	Water
1	—	Dischargeable to white	Dischargeability
—	—	5	Metal in dyebath: Copper
—	—	3	Iron
—	—	—	Solubility
Microscopic stain		Loose fur for hats—borax clearing 5	**NON-TEXTILE USAGE**
			REACTIONS
*Chlorine	*Wool (1) duller and somewhat faster to milling	*Wool (3) similar but less fast to carbonising, peroxide bleaching and stoving but faster to alk. milling and water	**NOTES**

C.I. Mordant Blue	48	49		50
CHEMICAL CLASS	Anthraquinone	Azo		Anthraquinone
C.I. CONSTITUTION NUMBER	62120			58550
HUE: Daylight	Bright Blue	Greenish Blue		Greenish Navy
Artificial light (tungsten)	Slightly greener	Slightly greener		Slightly greener
DYEING: WOOL	1, 2*, 3	1		3
Staining other fibres	Afterchrome: Acetate and Cellulose—*u*, Silk—*ss*	Acetate and Cotton—*vss*, Silk—*hs*		Acetate, Cellulose and Silk—*ss*
DYEING: OTHER FIBRES				
PRINTING		Wool: Chromium fluoride Vigoureux printing		Wool: Chromium acetate
FASTNESS PROPERTIES ETC.				
Method	ISO	AATCC	ISO	ISO
Substrate	Wool (1 and 2)	Wool (1)	Wool (1)	Wool (3)
Alkali	4–5	—	5	3–4
Cross Dyeing Wool Acetic/Sulphuric	—	—	–/4*	—
Carbonising	4–5	4–5	5	5
Chlorination	—	5	—	—
Decatising	4–5	5	5	4
Hot Pressing	5	5	5	4–5
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	5–6	—	4–5	—
normal	6	4	5–6	5–6
2× normal	6–7	—	6–7	—
Milling: Alkaline	4–5	4	4	3
Acid	—	—	3–4	4
Peroxide Bleaching	2	—	—	1
Perspiration	5	5	4	3–4
Potting	3–4	—	5	2
Sea Water	5	5	5	3–4
Stoving	5	—	5	4–5
Washing	5	—	4	3
Water	5	—	5	4
Dischargeability	Not dischargeable to white	2		Not dischargeable to white
Metal in dyebath: Copper	Scarcely altered	4–5		Slightly weaker
Iron	Greener, duller	2		Slightly greener and weaker
Solubility	Very good	—		—
NON-TEXTILE USAGE		See Leather Dyes section		Biological stain
REACTIONS				
NOTES	*Aftertreated with chromium fluoride instead of bichromate yields clearer and redder dyeings of practically the same fastness	*Bisulphate		

51	52	53	C.I. Mordant Blue
Thiazine 52055	Triphenylmethane 42015		CHEMICAL CLASS C.I. CONSTITUTION NUMBER
Greenish Navy Duller and greener	Greenish Blue Greener	Greenish Navy Little change	HUE: Daylight Artificial light (tungsten)
1, 3 Afterchrome: Acetate and Cellulose—*hs*, Nylon—*d*		1, 2 Afterchrome: Acetate—*vss*, Cotton—*s*, Silk—*hs*	DYEING: WOOL Staining other fibres
Nylon: Afterchrome	Silk: Afterchrome		DYEING: OTHER FIBRES
	Silk and Cotton: Cr mordant Acetate: With and without Cr mordant		PRINTING

AATCC Wool (1)	ISO Silk (dyed)	ISO Cotton	ISO Wool (2)	FASTNESS PROPERTIES ETC.
3	—	—	—	Method
—	—	—	—	Substrate
3–4	—	—	3–4	Alkali
—	—	2–3*	4	Cross Dyeing Wool Acetic/Sulphuric
4	—	—	4–5	Carbonising
				Chlorination
				Decatising
4	4	—	5	Hot Pressing
4	—	—	—	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
5	1	1	5–6	normal
6	—	—	6–7	2× normal
3	1–2	—	4–5	Milling: Alkaline
—	—	—	—	Acid
1	1	—	—	Peroxide Bleaching
4	3	—	5	Perspiration
4	—	—	4–5	Potting
5	—	—	5	Sea Water
3–4	3	—	—	Stoving
3	2–3	4	4–5	Washing
4	5	—	5	Water
—	—		—	Dischargeability
Unaltered	—		4–5	Metal in dyebath: Copper
Weaker and greener	—		4–5	Iron
Sol. cold and hot water	—		—	Solubility

			NON-TEXTILE USAGE
On wool: HNO_3 conc.—yellowish green			REACTIONS
	*Chlorine		NOTES

C.I. Mordant Blue	54	55	56
CHEMICAL CLASS	Monoazo	Triphenylmethane	Oxazine
C.I. CONSTITUTION NUMBER	16685	43835	51120
HUE: Daylight	Dull Greenish Blue	Bright Greenish Blue	Greenish Blue
Artificial light (tungsten)	Greener and duller		
DYEING: WOOL	1, 3		1
Staining other fibres	Afterchrome: Acetate and Cellulose—*u*, Nylon—*hs*, Silk—*s*		Acetate—*u*, Cellulose and Silk—*ss*, Nylon—dyed violet
DYEING: OTHER FIBRES	Nylon: Afterchrome	Silk: Afterchrome, Mordant	
PRINTING	Wool: Chromium acetate Vigoureux printing	Silk: Chromate Cotton: Chromium acetate, chromate	

FASTNESS PROPERTIES ETC.

Method	AATCC	ISO	ISO	AATCC	
Substrate	Wool (1)	Wool (1)	Cotton	Wool (1)	Cotton
Alkali	5	5	—	—	—
Cross Dyeing Wool Acetic/Sulphuric	—	—	—	—	—
Carbonising	5	5	—	—	—
Chlorination	—	—	3*	—	2*
Decatising	4–5	4–5	—	—	—
Hot Pressing	5	5	—	3	—
Light: ⅓–½ normal	—	5	2	—	3
normal	5–6	5–6	3	5	4
2× normal	—	6	4	—	5
Milling: Alkaline	5	5	—	2–3	—
Acid	—	2	—	—	—
Peroxide Bleaching	2	2	—	2–3	—
Perspiration	5	3	—	3	—
Potting	3–4	2	—	3	—
Sea Water	5	4	—	3–4	—
Stoving	5	4	—	—	—
Washing	5	5	4	3	4
Water	5	4–5	—	—	—
Dischargeability	—		—	Not dischargeable	
Metal in dyebath: Copper	Much redder		—	Somewhat redder and stronger	
Iron	Destroyed		—	Weaker and duller	
Solubility	—		—	—	

NON-TEXTILE USAGE			
REACTIONS	On wool: HNO_3 conc.—dark green		
NOTES		*Chlorine	*Chlorine

57	58	59	C.I. Mordant Blue
Oxazine	Phthalocyanine	Oxazine 51125	CHEMICAL CLASS C.I. CONSTITUTION NUMBER
Bright Greenish Blue Little change	Bright Greenish Blue Greener	Bluish Green Little change	HUE: Daylight Artificial light (tungsten)
	As an acid dye, nothing gained by afterchroming		DYEING: WOOL Staining other fibres
Silk: Cr mordant Cotton: Pad with chromium acetate	Cotton and Rayon: Dye with NaCl at the boil, fix in a separate boiling bath containing chromium acetate and NaCl Silk: as wool	Cotton: Pad with chromium acetate	DYEING: OTHER FIBRES
Wool and Silk: Chromium lactate Cotton: Chromium acetate	Wool and Silk: Direct without a mordant. Cotton and Rayon: Neutral chromate + ammonium sulphocyanide or chromium acetate + resorcinol with 6 min. steaming	Wool, Silk and Cotton: Cr mordant	PRINTING
ISO Cotton / Silk — / — — / — — / — 3* / — — / — — / — 4 / 4 4–5 / 5 5 / 5–6 — / 3–4 — / — — / — — / 4–5 — / — — / — — / — 4–5 (40°C), 3 (100°C) / 4–5 — / — Not dischargeable — — —	ISO Cotton — — — A–5, B–5* — — 5–6 5–6 6 — — — — — — — A–5, B–4, C–4 5 Good — — —	ISO Printed cotton — — — 3–4* — — 3 3–4 4–5 — — — — — — — 3 — Unsuitable — — —	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
			NON-TEXTILE USAGE
			REACTIONS
*Chlorine	*Chlorine	*Chlorine	NOTES

C.I. Mordant Blue	60	61	62
CHEMICAL CLASS	Oxazine		
C.I. CONSTITUTION NUMBER			
HUE: Daylight	Bright Greenish Blue	Dull Blue	
Artificial light (tungsten)		Redder	
DYEING: WOOL		1, 2	
Staining other fibres		Afterchrome: Acetate and Cellulose—*u*, Silk—*ss*	
DYEING: OTHER FIBRES	Silk: Cr mordant Cotton: Pad with chromium acetate		
PRINTING	Wool and Silk: Chromium lactate Cotton: Chromium acetate		Wool, Silk and Cotton: Cr mordant

FASTNESS PROPERTIES ETC.

Method	ISO		ISO	ISO
Substrate	Cotton	Silk	Wool (1)	Cotton
Alkali	—	—	3	—
Cross Dyeing Wool Acetic/Sulphuric	—	—	–/1	—
Carbonising	—	—	4–5	—
Chlorination	3*	—	—	4*
Decatising	—	—	4	—
Hot Pressing	—	—	5	—
Light: ⅛–¼ normal	4	4	—	—
normal	4–5	5	5	2
2× normal	—	5–6	6–7	3
Milling: Alkaline	—	3–4	3–4	—
Acid	—	—	—	—
Peroxide Bleaching	—	—	—	—
Perspiration	—	4	4–5	—
Potting	—	—	2	—
Sea Water	—	—	3	—
Stoving	—	—	4	—
Washing	4–5 (40°C), 3 (100°C)	5	4	4–5
Water	—	—	3–4	—
Dischargeability	Not dischargeable		—	—
Metal in dyebath: Copper	—		4	—
Iron	—		1–2	—
Solubility	—		—	—

NON-TEXTILE USAGE			
REACTIONS			
NOTES	*Chlorine		*Chlorine

63	64	65	C.I. Mordant Blue
		Oxazine	CHEMICAL CLASS
			C.I. CONSTITUTION NUMBER
Dull Blue Redder	Bright Blue Redder	Bright Blue Little change	HUE: Daylight Artificial light (tungsten)
1 Acetate and Silk—*hs*, Cellulose—*u*	1, 2 Afterchrome: Acetate and Silk—*hs*, Cellulose—*u*		DYEING: WOOL Staining other fibres
			DYEING: OTHER FIBRES
Wool: Cr mordant Vigoureux printing		Wool and Silk: Chromium lactate	PRINTING
ISO Wool (1) 4–5 — 5 — 4–5 5 — 6 — 5 — 4 4 2–3 4 4 — 5 — — — —	ISO Wool (1) 3–4 — 5 — 4–5 5 3 4 4–5 4–5 — — 5 5 5 4–5 5 5 — 4–5 2 —	ISO Silk — — — — — — — 6 — 3–4 — — 3 — — — 2–3 — Not dischargeable — — —	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
			NON-TEXTILE USAGE
			REACTIONS
			NOTES

C.I. Mordant Blue	66	67	68
CHEMICAL CLASS		Oxazine	Oxazine
C.I. CONSTITUTION NUMBER			
HUE: Daylight	Bright Blue	Bright Blue	Bright Blue
Artificial light (tungsten)	Redder	Little change	Little change
DYEING: WOOL			
Staining other fibres			
DYEING: OTHER FIBRES		Cotton: Pad with chromium acetate	Cotton: Pad with chromium acetate
PRINTING	Wool, Silk and Cotton: Cr mordant	Wool and Silk: Chromium lactate Cotton: Chromium acetate	Wool and Silk: Chromium lactate Cotton: Chromium acetate
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Cotton	Printed cotton	Cotton
Alkali	—	—	—
Cross Dyeing Wool Acetic/Sulphuric	—	—	—
Carbonising	—	—	—
Chlorination	3–4*	4*	4*
Decatising	—	—	—
Hot Pressing	—	—	—
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	—	2	—
normal	3–4	3	4–5
2× normal	—	3–4	—
Milling: Alkaline	—	—	—
Acid	—	—	—
Peroxide Bleaching	—	—	—
Perspiration	—	—	—
Potting	—	—	—
Sea Water	—	—	—
Stoving	—	—	—
Washing	4–5	4 (40°C), 2–3 (100°C)	4 (40°C), 3 (100°C)
Water	—	—	—
Dischargeability	2–3	Not dischargeable	Not dischargeable
Metal in dyebath: Copper	—	—	—
Iron	—	—	—
Solubility	—	—	—
NON-TEXTILE USAGE			
REACTIONS			
NOTES	*Chlorine	*Chlorine	*Chlorine

69	70	C.I. Mordant Blue
		CHEMICAL CLASS
		C.I. CONSTITUTION NUMBER
Bright Blue	Greenish Blue	**HUE:** Daylight Artificial light (tungsten)
		DYEING: WOOL Staining other fibres
		DYEING: OTHER FIBRES
		PRINTING
		FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
Anodised aluminium. Fastness: Light 8; Weather, very good; Heat (*a*) 6 h at 200°C deeper, (*b*) 1 h at 250°C deeper and duller	Anodised aluminium. Fastness: Light 7; Weather, good; Heat (*a*) 6 h at 200°C little change, (*b*) 1 h at 250°C deeper	**NON-TEXTILE USAGE**
		REACTIONS
		NOTES

C.I. Mordant Blue	71	72
CHEMICAL CLASS C.I. CONSTITUTION NUMBER		
HUE: Daylight Artificial light (tungsten)	Bright Reddish Navy	
DYEING: WOOL Staining other fibres		This C.I. Generic Name is discontinued, dyes formerly listed under it now appear under C.I. Mordant Blue 13:1
DYEING: OTHER FIBRES		
PRINTING		
FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: ⅓–½ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility		
NON-TEXTILE USAGE	Anodised aluminium. Fastness: Light 7–8; Weather, bad; Heat (*a*) 6 h at 200°C weaker and duller, (*b*) 1 h at 250°C much weaker and duller	
REACTIONS		
NOTES		

73	74	75	C.I. Mordant Blue
Monoazo	Anthraquinone	Azo	CHEMICAL CLASS
			C.I. CONSTITUTION NUMBER
Reddish Navy Slightly redder	Blue Trace redder	Dull Blue	HUE: Daylight Artificial light (tungsten)
2 Acetate and Cotton—*ss*	1 (acetic acid) Acetate and Viscose—*u* Cotton and Silk—*ss*		DYEING: WOOL Staining other fibres
Silk: Metachrome			DYEING: OTHER FIBRES
			PRINTING
ISO Wool (2) 5 –/5 5 — 5 4 4–5 5 6 4 — 4 4–5 3 5 5 4 5 — Becomes violet Redder and duller —	ISO Wool (1) 4 (yellower) — 4–5 3 4–5 — 5–6 6 6–7 — 4–5 3 5 3–4 5 5 4 — — 4 yellower 3–4 yellower, duller —		FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
			NON-TEXTILE USAGE
In substance: H_2SO_4 conc.—greenish grey, on diln—violet	In substance: H_2SO_4 conc.—bluish green, on diln—blue		REACTIONS
			NOTES

C.I. Mordant Blue	76	77	78
CHEMICAL CLASS	Azo	Phthalocyanine	Monoazo
C.I. CONSTITUTION NUMBER			14835
HUE: Daylight	Navy	Greenish Blue	Navy
Artificial light (tungsten)			
DYEING: WOOL			1
Staining other fibres			Acetate and Cellulose—*u*, Silk—*ss*
DYEING: OTHER FIBRES		Silk: Formic acid + mordant Cellulose: Neutral bath and afterchromed, or padded with chromium acetate	
PRINTING		Wool, Silk and Cotton: Chromium acetate	
FASTNESS PROPERTIES ETC.		ISO	AATCC and ISO
Method		Silk (dyed) / Cellulose	Wool (1)
Substrate			
Alkali		— / —	4–5
Cross Dyeing Wool Acetic/Sulphuric		— / —	—
Carbonising		— / —	4
Chlorination		— / —	4–5
Decatising		— / —	—
Hot Pressing		— / —	—
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal		— / —	—
normal		6 / 7	6
2× normal		— / —	—
Milling: Alkaline		— / —	3
Acid		— / —	—
Peroxide Bleaching		— / —	2–3
Perspiration		4–5 / —	3–4
Potting		— / —	—
Sea Water		— / —	4
Stoving		— / —	4–5
Washing		4–5 (100°C) / 4–5	4
Water		— / —	—
Dischargeability		Dischargeable to white	Poor
Metal in dyebath: Copper		—	Duller and bluer
Iron		—	Weaker and duller
Solubility		Good	Good
NON-TEXTILE USAGE			
REACTIONS			
NOTES			For use as an acid dye see C.I. Acid Red 12

79	80	81	C.I. Mordant Blue
Monoazo	Monoazo	Monoazo	CHEMICAL CLASS
14720	16570	16645	C.I. CONSTITUTION NUMBER
Navy	Deep Blue	Bluish Black	HUE: Daylight
			Artificial light (tungsten)
1	1	1	DYEING: WOOL
			Staining other fibres
			DYEING: OTHER FIBRES
			PRINTING
			FASTNESS PROPERTIES ETC.
ISO	ISO		Method
Wool (1)	Wool (1)	—	Substrate
4–5	2–3	—	Alkali
—	—	—	Cross Dyeing Wool Acetic/Sulphuric
4	4	—	Carbonising
—	—	—	Chlorination
4–5	3–4	—	Decatising
—	—	—	Hot Pressing
—	—	—	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
6	5–6	6	normal
—	—	—	2× normal
4	3–4	3	Milling: Alkaline
—	2	—	Acid
2	2	—	Peroxide Bleaching
3	3	4	Perspiration
2	2	3	Potting
4–5	—	—	Sea Water
4–5	4	—	Stoving
4	4–5	—	Washing
—	—	2–3	Water
Good	—	—	Dischargeability
Duller	—	—	Metal in dyebath: Copper
Much duller	—	—	Iron
Very good	—	—	Solubility
	Biological stain		NON-TEXTILE USAGE
			REACTIONS
For use as an acid dye see C.I. Acid Red 14	For use as an acid dye see C.I. Acid Red 29	For use as an acid dye see C.I. Acid Red 60	NOTES

C.I. Mordant Blue	82	
CHEMICAL CLASS	Disazo	
C.I. CONSTITUTION NUMBER		
HUE: Daylight	Greenish Navy	
Artificial light (tungsten)	Redder	
DYEING: WOOL	1, 2, 3	
Staining other fibres		
DYEING: OTHER FIBRES		
PRINTING		
FASTNESS PROPERTIES ETC.		
Method	AATCC	
Substrate	Wool (1)	
Alkali	3–4	
Cross Dyeing Wool Acetic/Sulphuric	—	
Carbonising	5	
Chlorination	—	
Decatising	4–5	
Hot Pressing	—	
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	—	
normal	6	
2× normal	—	
Milling: Alkaline	4–5	
Acid	—	
Peroxide Bleaching	4–5	
Perspiration	4–5	
Potting	4–5	
Sea Water	5	
Stoving	—	
Washing	4	
Water	—	
Dischargeability	Moderate to good	
Metal in dyebath: Copper	Duller	
Iron	Duller	
Solubility	Good	
NON-TEXTILE USAGE	Leather: On chrome tannage	
REACTIONS	In substance: H_2SO_4 conc. —bluish green	
NOTES	For use as an acid dye see C.I. Acid Blue 73	

C.I. Mordant Green	1	2	3
CHEMICAL CLASS		Monoazo	Triphenylmethane
C.I. CONSTITUTION NUMBER		11835	
HUE: Daylight	Olive	Olive	Dull Yellowish Green
Artificial light (tungsten)	Unchanged	Duller	Little change
DYEING: WOOL	1	1, 2, 3	
Staining other fibres	Acetate and Cellulose—*u*, Nylon 6—*s*, Silk—*ss*	Metachrome—Acetate and Cotton—*ss*, Silk—*s*, Viscose—*u*	
DYEING: OTHER FIBRES			Silk: Chromium lactate Cotton: Pad with chromium acetate
PRINTING			Silk: Chromium lactate Cotton: Chromium acetate
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Wool (1)	Wool (2)	Cotton / Silk
Alkali	5	4–5	— / —
Cross Dyeing Wool Acetic/Sulphuric	–/4	—	— / —
Carbonising	4	4	— / —
Chlorination	—	—	3–4* / —
Decatising	4	4	— / —
Hot Pressing	4	4	— / —
Light: ⅓–½ normal	5–6	—	6–7 / 6
normal	6	6	7 / 6–7
2× normal	6–7	—	7–8 / 7
Milling: Alkaline	5	4–5	— / 4
Acid	4	5	— / —
Peroxide Bleaching	4	3–4	— / —
Perspiration	5	4	— / 5
Potting	5	4	— / —
Sea Water	5	5	— / —
Stoving	4	5	— / —
Washing	5	5	4–5 / 5
Water	5	5	— / —
Dischargeability	Not dischargeable	Dyed metachrome, discharges to white	Not dischargeable
Metal in dyebath: Copper	Duller, bluer	—	—
Iron	Browner	—	—
Solubility	Very good	Suitable for package dyeing	—
NON-TEXTILE USAGE			
REACTIONS			
NOTES		Dyed afterchrome is somewhat yellower and on a mordant somewhat darker than when dyed metachrome	*Chlorine

C.I. Mordant Green	4	5	6
CHEMICAL CLASS	Nitroso	Azo	Anthraquinone
C.I. CONSTITUTION NUMBER	**10005**		
HUE: Daylight	Brownish Olive (Cr)† Yellowish Green (Fe)	Bright Yellowish Green	Yellowish Green
Artificial light (tungsten)	Redder (Cr), Bluer (Fe)	Little change	Little change
DYEING: WOOL		1	
Staining other fibres		Afterchrome: Acetate and Cotton—*u*, Silk—*ss*	
DYEING: OTHER FIBRES	Cotton: Cr or Fe mordant, faster to light on iron than on chrome		
PRINTING	Wool, Silk and Cotton: Fe mordant	Wool: Chromium fluoride Vigoureux printing	Cotton: Cr mordant

FASTNESS PROPERTIES ETC.				
Method	ISO	AATCC	ISO	ISO
Substrate	Printed cotton	Wool (1)	Wool (1)	Cotton
Alkali	—	—	5	—
Cross Dyeing Wool Acetic/Sulphuric	—	—	–/4–5	—
Carbonising	—	1–2	2–3	—
Chlorination	3–4*	4–5	—	2*
Decatising	—	4–5	5	—
Hot Pressing	—	4–5	4–5	—
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	5	—	6–7	3
normal	6	5	6–7	4
2× normal	6–7	—	7	4
Milling: Alkaline	—	4	4–5	—
Acid	—	—	1	—
Peroxide Bleaching	—	—	—	—
Perspiration	—	2–3	5	—
Potting	—	1–2	4–5	—
Sea Water	—	5	—	—
Stoving	—	—	4–5	—
Washing	4	—	4–5	5
Water	—	—	—	—
Dischargeability	—	2		Poor
Metal in dyebath: Copper	—	3–4		—
Iron	—	2		—
Solubility	—	Very good		—

NON-TEXTILE USAGE	Biological stain		
REACTIONS			
NOTES	*Chlorine †Drab on nickel, terra cotta on cobalt mordant		*Chlorine

7	8	9	C.I. Mordant Green
Azo	Azo	Monoazo	CHEMICAL CLASS
		19515	C.I. CONSTITUTION NUMBER
Bright Yellowish Green Little change	Bright Yellowish Green Little change	Dull Bluish Green Yellower	HUE: Daylight Artificial light (tungsten)
		1, 2 Afterchrome: Acetate and Cellulose—*u*	DYEING: WOOL Staining other fibres
Cotton: Pad with chromium acetate	Silk: Chromium lactate Cotton: Pad with chromium acetate	Silk: Afterchrome	DYEING: OTHER FIBRES
Wool and Silk: Chromium lactate Cotton: Chromium acetate	Wool and Silk: Chromium lactate Cotton: Chromium acetate	Wool: Cr mordant	PRINTING

ISO Cotton	ISO Cotton	ISO Wool (1)	ISO Wool (2)	Silk	FASTNESS PROPERTIES ETC.
					Method
—	—	4–5	5	—	Substrate
—	—	4/–	—/3	—	Alkali
—	—	4	5	—	Cross Dyeing Wool Acetic/Sulphuric
3*	3–4*	—	3	—	Carbonising
—	—	5	5	—	Chlorination
					Decatising
—	—	5	4–5	5	Hot Pressing
—	3–4	3	3	—	Light: ⅓–½ normal
3–4	4–5	4	3–4	4	normal
4	5	5	4	—	2× normal
—	—	3–4	5	2	Milling: Alkaline
—	—	—	2–3	—	Acid
—	—	5	3	2	Peroxide Bleaching
—	—	5	5	4	Perspiration
—	—	4	2–3	—	Potting
—	—	4	5	—	Sea Water
—	—	5	4	3–4	Stoving
4 (40°C), 3(100°C)	4–5 (40°C), 3–4 (100°C)	5	5	4–5	Washing
—	—	5	5	5	Water
Not dischargeable	Dischargeable to white	2			Dischargeability
—	—	Bluer and duller			Metal in dyebath: Copper
—	—	Much duller			Iron
—	—	—			Solubility

		Leather: on chrome tannage	NON-TEXTILE USAGE
		In substance: H_2SO_4 conc.—red, on diln—slightly yellower. HNO_3 conc.—red. 10% NaOH—greyish	REACTIONS
*Chlorine	*Chlorine		NOTES

C.I. Mordant Green	10	11
CHEMICAL CLASS	Disazo	Disazo
C.I. CONSTITUTION NUMBER	26920	20440
HUE: Daylight	Deep Dull Bluish Green	Dull Bluish Green
Artificial light (tungsten)	Slightly yellower	Slightly yellower
DYEING: WOOL	1, 2, 3	1, 2
Staining other fibres	Afterchrome: Acetate—*ss*, Cellulose—*u*, Silk—*hs* Metachrome: Acetate and Viscose—*u*, Cotton—*ss*, Silk—*hs*	Afterchrome: Acetate and Cotton—*s*, Silk—*hs* Viscose—*u* Metachrome: Acetate and Cotton—*s*, Silk—*hs*, Viscose—*s*
DYEING: OTHER FIBRES		
PRINTING		Wool: Cr mordant

FASTNESS PROPERTIES ETC.

Method	ISO		ISO	
Substrate	Wool (1)*	Wool (2)	Wool (1)	Wool (2)
Alkali	4–5	4–5	5	4–5
Cross Dyeing Wool Acetic/Sulphuric	5/4–5	5/4–5	—	—
Carbonising	4	4–5	5	5
Chlorination	5	5	—	—
Decatising	4–5	4–5	5	5
Hot Pressing	5	5	4–5	5
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	4–5	5	2–3	2–3
normal	6	6	3	3
2× normal	7	7	3	3
Milling: Alkaline	4–5	4–5	3–4	3
Acid	4	4–5	4	4
Peroxide Bleaching	4–5	5	2	2
Perspiration	4–5	5	4	4
Potting	4	4–5	1	3
Sea Water	5	5	5	5
Stoving	4–5	4–5	4–5	4–5
Washing	5	4–5	3–4	3
Water	5	5	5	5
Dischargeability	—		Dyed afterchrome, dischargeable to white	
Metal in dyebath: Copper	1		Weaker (1), Little change (2)	
Iron	1		Weaker (1), Yellower (2)	
Solubility	—		—	

NON-TEXTILE USAGE		
REACTIONS		
NOTES	*Wool (3) similar fastness to carbonising; chlorination, acid milling, and potting significantly lower	

12	13	14	C.I. Mordant Green
Disazo	Triphenylmethane	Monoazo	CHEMICAL CLASS
27520	42005	17125	C.I. CONSTITUTION NUMBER
Greenish Grey→Dull Bluish Green Brighter		Dull Green Somewhat yellower	HUE: Daylight Artificial light (tungsten)
1, 2, 3 Afterchrome: Acetate and Cotton—*ss*, Nylon and Silk—*hs*, Viscose—*u*	3	1, 2, 3 Afterchrome: Acetate—*u*, Cellulose—*ss*, Nylon 6 and Silk—*s* Metachrome: Acetate—*u*, Cellulose—*ss*, Silk—*hs*	DYEING: WOOL Staining other fibres
Silk: Afterchrome		Nylon: Afterchrome	DYEING: OTHER FIBRES
Wool: Cr mordant	Cotton: Cr acetate, fuller prints are produced on oiled cotton	Wool: Cr mordant Vigoureux printing	PRINTING

AATCC	ISO			ISO		FASTNESS PROPERTIES ETC.
Wool (1)	Wool (1)	Wool (2)	Wool (3)	Wool (1)	Wool 2	
4	5	5	—	5	5	Method
—	—	—	—	–/3	—	Substrate
3–4	5	4	—	5	5	Alkali
—	—	—	—	—	—	Cross Dyeing Wool Acetic/Sulphuric
4–5	4	4–5	—	3–4	3–4	Carbonising
						Chlorination
						Decatising
—	5	5	—	4	4	Hot Pressing
3	4	—	—	3	4	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
4	4	2	Poor	3–4	4–5	normal
5	5	—	—	4–5	5	2× normal
4	3	4–5	Moderate	4	3–4	Milling: Alkaline
—	3	—	—	5	—	Acid
2–3	2	2	—	4	3	Peroxide Bleaching
5	3–4	4–5	—	5	5	Perspiration
3–4	4	3	—	4	4	Potting
5	5	5	—	5	5	Sea Water
5	4–5	4	—	5	5	Stoving
5	3	—	—	4	4	Washing
—	5	5	—	5	5	Water
Dischargeable to white			—	Dischargeable to white		Dischargeability
Little—much altered			—	Trace clearer and bluer		Metal in dyebath: Copper
Bluer			—	Unaffected		Iron
	—		—	Suitable for package dyeing		Solubility
						NON-TEXTILE USAGE
						REACTIONS
				Afterchrome dyeings are slightly yellower than metachrome dyeings		NOTES

C.I. Mordant Green	15	16
CHEMICAL CLASS	Disazo	Monoazo
C.I. CONSTITUTION NUMBER	26925	*
HUE: Daylight	Dull Bluish Green	Green
Artificial light (tungsten)	Violet (on silk) Slightly yellower	Slightly yellower
DYEING: WOOL	1, 2, 3. Good exhaustion, poor levelling, excess acid ppts the dye	3, good exhaustion and levelling
Staining other fibres	—	Acetate—*u*, Cellulose—*ss*, Nylon—*hs*, reddish violet, Silk—*hs*
DYEING: OTHER FIBRES	Silk: Afterchrome from a neutral bath, violet of good fastness to washing but poor fastness to light Nylon: Afterchrome from neutral bath	
PRINTING		Wool: Cr mordant

FASTNESS PROPERTIES ETC.			
Method	AATCC	ISO	AATCC
Substrate	Wool (1)	Wool (1)*	Wool (3)
Alkali	5	5	4
Cross Dyeing Wool Acetic/Sulphuric	—	5/4–5	—
Carbonising	3–4	3–4	3
Chlorination	—	5	—
Decatising	—	5	3
Hot Pressing	2	4–5	5
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	—	4–5	—
normal	5	5–6	6
2× normal	—	6–7	—
Milling: Alkaline	5	5	3
Acid	—	2–3	—
Peroxide Bleaching	4	2–3	—
Perspiration	5	4–5	5
Potting	5	4	3
Sea Water	5	4–5	5
Stoving	3	3	3
Washing	5	5	3–4
Water	—	4–5	—
Dischargeability	—		3
Metal in dyebath: Copper	Much bluer		Somewhat duller
Iron	Destroyed		Duller and yellower
Solubility	Moderate		Slightly sol. cold, sol. hot water

NON-TEXTILE USAGE	See Leather Dyes section	Loose fur and hat bodies, borax clearing fastness—fairly good
REACTIONS		In substance: H_2SO_4 conc.—dull
NOTES	*Wool (2) similar	*Preparation: Diazonitroamidophenol→H acid

17	18	C.I. Mordant Green
Monoazo 17225		CHEMICAL CLASS C.I. CONSTITUTION NUMBER
Dull Bluish Green Slightly yellower	Dull Bluish Green Slightly brighter	HUE: Daylight Artificial light (tungsten)
1 Afterchrome: Acetate and Cellulose—*u–s*	1 Afterchrome: Acetate and Cellulose—*ss*, Silk—*hs*	DYEING: WOOL Staining other fibres
Silk: Afterchrome Nylon: Afterchrome (medium substantivity)	Nylon: Afterchrome, 2 h boil for lake formation	DYEING: OTHER FIBRES
Wool: Chromium acetate	Vigoureux printing	PRINTING

AATCC Wool (1)	ISO Wool (1)	ISO Silk	ISO Wool (1)	FASTNESS PROPERTIES ETC.
5	4–5	—	5	Method
—	–/3–4	—	–/4–5	Substrate
3	3	—	4	Alkali
—	4	—	4	Cross Dyeing Wool Acetic/Sulphuric
4–5	4–5	—	4–5	Carbonising
				Chlorination
				Decatising
5	5	5	5	Hot Pressing
3	2	—	5–6	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
4	2	3	6	normal
5	2–3	—	6	2× normal
4–5	4–5	2–3	4–5	Milling: Alkaline
—	2–3	—	4–5	Acid
2	1–2	1	3–4	Peroxide Bleaching
4–5	5	4	4–5	Perspiration
3	3–4	—	4–5	Potting
5	4–5	—	5	Sea Water
4	3–4	4	5	Stoving
4–5	4–5	4–5	4–5	Washing
—	5	5	5	Water
	Poor		2	Dischargeability
	Much bluer		3–4	Metal in dyebath: Copper
	Destroyed		1	Iron
	Very good		—	Solubility

		NON-TEXTILE USAGE
On wool: HNO_3 conc.—brown to olive		REACTIONS
	Good absorption in the infra red	NOTES

C.I. Mordant Green	19		20
CHEMICAL CLASS	Anthraquinone		Monoazo
C.I. CONSTITUTION NUMBER	67440		
HUE: Daylight	Bluish Green		Bluish Green
Artificial light (tungsten)	Little change		Slightly duller
DYEING: WOOL	3		1
Staining other fibres	Mordant: Acetate and Cellulose—*ss*		Afterchrome: Acetate and Cellulose—*u*, Silk—*hs*
DYEING: OTHER FIBRES	Silk: Mordant		Silk: Afterchrome Nylon: Afterchrome, medium substantivity
PRINTING	Cotton: Cr mordant		Wool: Chromium acetate
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Wool	Silk	Wool (1)
Alkali	4	—	5
Cross Dyeing Wool Acetic/Sulphuric	–/3–4	–/2–3	–/1–2
Carbonising	4	—	4
Chlorination	—	—	—
Decatising	4	—	4–5
Hot Pressing	4	3	4–5
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	5–6	5–6	3
normal	6	5–6	3–4
2× normal	6–7	6	4
Milling: Alkaline	4–5	3	3–4
Acid	4	—	—
Peroxide Bleaching	3	2	3–4
Perspiration	4	4	4
Potting	3	—	2–3
Sea Water	4–5	—	4–5
Stoving	4–5	4	4
Washing	4–5	5	4–5
Water	5	5	5
Dischargeability	Not dischargeable		—
Metal in dyebath: Copper	Slightly duller		3
Iron	Duller		1
Solubility	Soluble, decomposes with pptn on boiling		—
NON-TEXTILE USAGE			
REACTIONS			
NOTES			

21	22	23	C.I. Mordant Green
Triphenylmethane	Xanthene	Triphenylmethane	CHEMICAL CLASS
43845	45510	42010	C.I. CONSTITUTION NUMBER
Yellowish Green Yellower			HUE: Daylight Artificial light (tungsten)
	3 Mordant: Acetate and Cellulose—*ss*, Silk—*hs*		DYEING: WOOL Staining other fibres
Silk: Afterchrome	Silk and Cotton: Al or Cr mordant	Silk: Afterchrome	DYEING: OTHER FIBRES
	Wool, Silk and Cotton: Cr mordant Suitable as an illuminating colour in formaldehyde sulphoxylate and tin discharges	Silk and Cotton: Cr mordant Acetate: With and without Cr mordant	PRINTING

ISO Silk	AATCC AA	ISO Wool	ISO Silk (Al)	ISO Silk (Cr)	ISO Dyed silk	ISO Cotton	FASTNESS PROPERTIES ETC.
—	5	5	—	—	—	—	Method
—	—	4–5/4	–/2–3	–/3–4	—	—	Substrate
—	4	4–5	—	—	—	—	Alkali
—	—	2	—	—	—	2–3*	Cross Dyeing Wool Acetic/Sulphuric
—	4	4	—	—	—	—	Carbonising
							Chlorination
							Decatising
4	5	5	2	4–5	5	—	Hot Pressing
—	—	4–5	5	2	—	—	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
2	4	5	5	2	1	1	normal
—	—	5–6	5	2	—	—	2× normal
1	5	4	5	4	2	—	Milling: Alkaline
—	—	4–5	—	—	—	—	Acid
1	—	1–2	1	1	1	—	Peroxide Bleaching
3	4	4–5	4	5	3	—	Perspiration
—	5	4	—	—	—	—	Potting
—	5	5	—	—	—	—	Sea Water
2	4	5	4	5	4	—	Stoving
2	5	3–4	5	5	2–3	3–4	Washing
5	—	5	5	5	5	—	Water
—		Not dischargeable			—		Dischargeability
—		Little change			—		Metal in dyebath: Copper
—		Duller and weaker			—		Iron
—		—			—		Solubility

	Loose fur for hats, borax clearing—very good Leather: gloving and clothing velour leathers. Biological stain
	On wool: Sulphoxylate-formaldehyde—yellow brown re-oxidising to green
	*Chlorine

NON-TEXTILE USAGE

REACTIONS

NOTES

C.I. Mordant Green	24	25
CHEMICAL CLASS	Monoazo	
C.I. CONSTITUTION NUMBER	**11395**	
HUE: Daylight	Dull Green	Dull Green
Artificial light (tungsten)	Weaker and a little duller	Little change
DYEING: WOOL	1, 2	1, 2, 3
Staining other fibres	Metachrome: Acetate—*s*, Cellulose—*ss*, Silk—*hs*	Afterchrome: Acetate—*ss–s*, Cellulose—*u–ss*, Silk—*hs* Metachrome: Acetate and Cellulose—*ss–s*, Silk—*hs* Mordant: Acetate and Cellulose—*ss*, Silk—*hs*
DYEING: OTHER FIBRES	Nylon: Afterchrome	
PRINTING		Wool: Cloth and Vigoureux printing

FASTNESS PROPERTIES ETC.

Method	ISO		ISO	
Substrate	Wool (1)	Wool (2)	Wool (1)	Wool (2)
Alkali	4	4	5	4–5
Cross Dyeing Wool Acetic/Sulphuric	–/2	–/2	—	—
Carbonising	3	3–4	5	4–5
Chlorination	4	4	—	—
Decatising	3–4	4	5	4–5
Hot Pressing	4	4	4	4
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	3	3–4	5	5
normal	3–4	4	5–6	5–6
2× normal	4–5	5	6	6
Milling: Alkaline	4–5	4–5	4	4
Acid	3	3	4	4
Peroxide Bleaching	1–2	1–2	3	3
Perspiration	3–4	3–4	4	4
Potting	2–3	3	3	1–2
Sea Water	4	4	4–5	4–5
Stoving	2–3	2–3	4–5	4–5
Washing	4–5	5	4	4
Water	5	5	5	5
Dischargeability	Dischargeable to white		—	
Metal in dyebath: Copper	3 (1), 3–4 (2)		3–4 (1), 4–5 (2), 5 (3)	
Iron	2 (1), 2–3 (2)		4 (1 and 2), 4–5 (3)	
Solubility	—		Soluble in cold water	

NON-TEXTILE USAGE		Hat dyeing, very good fastness to borax clearing
REACTIONS		In substance: H_2SO_4 conc.—dark greenish grey, on diln pale yellow green with slight ppt
NOTES		

26	27	28	C.I. Mordant Green
Monoazo **18180**	Monoazo	Monoazo **17220**	**CHEMICAL CLASS** **C.I. CONSTITUTION NUMBER**
Dull Green Unchanged	Yellowish Green Unchanged	Dull Bluish Green Unchanged	**HUE:** Daylight Artificial light (tungsten)
1, 2, 3 Levels well but exhausts slowly Afterchrome: Nylon—*hs* Metachrome: Acetate and Cellulose—*ss*, Silk—*hs*	Slightly different chemically from C.I. Mordant Green 26 but similar in properties and application	1 Acetate and Cellulose—*u*	**DYEING: WOOL** Staining other fibres
			DYEING: OTHER FIBRES
Wool: Vigoureux printing			**PRINTING**
AATCC Wool (1) / ISO Wool (1) / ISO Wool (2) / ISO Wool (1) 5 / 5 / 5 / 5 — / –/4–5 / — / — 5 / 4 / 4 / 4 — / — / — / — — / 5 / 5 / 4–5 3 / 5 / 4 / 5 — / 5 / 5 / — 7 / 6 / 6 / 3–4 — / 6–7 / 6–7 / — 3 / 4 / 4 / 4 — / 3 / 4 / — 3 / 3–4 / 4 / — 5 / 4–5 / 5 / 5 — / 3 / 3 / — 5 / 4–5 / 5 / 5 5 / 4 / 3 / 5 5 / 5 / 5 / 4–5 — / 4–5 / 5 / 5 (AATCC) A, 2; C; 3–4 Duller (1), Duller, bluer (2) Destroyed (1), Slight. yellower (2) Suitable for package dyeing			**FASTNESS PROPERTIES ETC.** Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
			NON-TEXTILE USAGE
			REACTIONS
Afterchrome dyeings are somewhat yellower than metachrome dyeings and become even more yellow on decatising			**NOTES**

C.I. Mordant Green	29		30		31	
CHEMICAL CLASS	Azo		Monoazo		Triphenylmethane	
C.I. CONSTITUTION NUMBER			17130		44530	
HUE: Daylight	Dull Green		Bluish Green		Green	
Artificial light (tungsten)	Somewhat duller		Little change		Yellower	
DYEING: WOOL	1, 2		1, 3 Mordant dyeings are bluer than afterchromes		1, 2, 3	
Staining other fibres	Afterchrome: Acetate, Cellulose and Silk—*u* Metachrome: Acetate and Viscose—*u*, Cotton—*ss*, Silk—*hs*		Afterchrome: Acetate—*vss*, Cotton—*u*, Silk—*hs*		Afterchrome: Acetate and Viscose—*u*, Cotton and Silk—*ss*	
DYEING: OTHER FIBRES	Nylon: Afterchrome, high substantivity				Silk: Afterchrome Nylon: Afterchrome, 90–120 min boil for lake formation	
PRINTING					Wool: Chromium acetate	
FASTNESS PROPERTIES ETC.						
Method	ISO		AATCC	ISO	AATCC	ISO
Substrate	Wool (1)	Wool (2)	Wool (1)		Wool (1)	Wool (1)†
Alkali	5	5	—	4–5	—	2–3
Cross Dyeing Wool Acetic/Sulphuric	3/1	3/1	—	–/4	—	5/5
Carbonising	4–5	4–5	4	5	4–5	5
Chlorination	4	3–4	4–5	—	4	4
Decatising	4–5	4–5	5	5	—	5
Hot Pressing	5	5	4–5	4	5	5
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	5–6	6	—	2	3	4
normal	6–7	6–7	4–5	3	4	4
2× normal	7	7	—	4	—	5
Milling: Alkaline	5	4–5	4	4	3	2–3*
Acid	—	—	—	3	—	4–5
Peroxide Bleaching	2–3	2–3	—	—	—	1–2
Perspiration	5	5	4	5	3–4	4
Potting	5	4	—	4–5	4–5	4
Sea Water	5	5	4–5	—	3–4	5
Stoving	4	4	—	4	—	5
Washing	5	5	—	4	3	4
Water	5	5	—	—	5	5
Dischargeability	—		3		Unsuitable	
Metal in dyebath: Copper	Strong change (1), slight change (2)		4		4–5	
Iron	Strong change (1), slight change (2)		1		4–5	
Solubility	—		Good		—	
NON-TEXTILE USAGE						
REACTIONS						
NOTES					*Hue returns on acidifying with H_2SO_4 †Wool (2) and (3) similar	

32	33	34	C.I. Mordant Green
Monoazo		Monoazo	CHEMICAL CLASS
		17650	C.I. CONSTITUTION NUMBER
Dull Green Yellower	Dull Green Yellower	Dull Bluish Green Brighter, slightly yellower	HUE: Daylight Artificial light (tungsten)
1 Afterchrome: Acetate—*u* Cellulose—*ss* Silk—*hs*	1, 2, 3 Exhausts well neutral Afterchrome and Metachrome: Acetate and Cellulose—*u*, Silk—*hs*	1, 2, 3 Exhausts well neutral Afterchrome and Metachrome: Acetate and Cellulose—*ss*, Silk—*hs*	DYEING: WOOL Staining other fibres
Silk: Afterchrome			DYEING: OTHER FIBRES
	Wool: Cr mordant Vigoureux printing	Wool: Cr mordant Vigoureux printing	PRINTING
ISO Wool (1) 4 –/2 5 — 4–5 5 3 3–4 4–5 4–5 — 5 5 4 5 5 5 5 — 1–2 2 —	ISO Wool (1)* 5 5/4–5 5 3–4 4–5 5 4–5 5–6 6–7 5 5 4–5 5 5 5 5 5 5 — Slight change (1), no change (2) Slight change (1), no change (2) Suitable for package dyeing	ISO Wool (1)* 5 5/4 5 3–4 4–5 5 4–5 5–6 6–7 5 5 4–5 5 5 5 5 5 5 — Slight change (1), no change (2) Strong change (1), no change (2) Suitable for package dyeing	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
			NON-TEXTILE USAGE
			REACTIONS
	*Wool (2) very similar but fastness to milling and potting somewhat lower	*Wool (2) very similar. Changes in hue on long boiling but this can be overcome by dyeing at 95°C but with some decrease in fastness to milling and potting	NOTES

C.I. Mordant Green	35	36	37
CHEMICAL CLASS	Monoazo	Monoazo	
C.I. CONSTITUTION NUMBER		17235	
HUE: Daylight	Dull Green	Dull Green	
Artificial light (tungsten)	Little change	Slightly yellower and brighter	
DYEING: WOOL	1, 2, 3	1	
Staining other fibres	Afterchrome and Metachrome: Acetate and Cellulose—*ss*, Silk—*hs*	Afterchrome: Acetate—*u*, Cellulose—*ss*, Silk—*hs*	This C.I. Generic Name is discontinued, dyes formerly listed under it now appear under C.I. Mordant Green 14
DYEING: OTHER FIBRES	Silk: Afterchrome	Silk: Afterchrome	
PRINTING	Wool: Chromium acetate		
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	
Substrate	Wool (1)*	Wool (1)	
Alkali	5	4–5	
Cross Dyeing Wool Acetic/Sulphuric	4–5/4	–/2	
Carbonising	4–5	5	
Chlorination	5	—	
Decatising	5	5	
Hot Pressing	5	5	
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	5	2	
normal	6	2–3	
2× normal	6–7	3–4	
Milling: Alkaline	4–5	4	
Acid	4–5	—	
Peroxide Bleaching	3–4	—	
Perspiration	5	5	
Potting	4–5	4	
Sea Water	5	4–5	
Stoving	5	4–5	
Washing	5	5	
Water	5	5	
Dischargeability	Unsuitable	—	
Metal in dyebath: Copper	1	1–2	
Iron	1	1–2	
Solubility	Good	—	
NON-TEXTILE USAGE			
REACTIONS			
NOTES	*Wool (2) and (3) very similar		

38	39	40	C.I. Mordant Green
Azo	Monoazo		CHEMICAL CLASS
			C.I. CONSTITUTION NUMBER
Dull Bluish Green Bluer	Dull Bluish Green Yellower	Dull Green Somewhat yellower	HUE: Daylight Artificial light (tungsten)
1 Afterchrome: Acetate and Cellulose—*u*	1 Afterchrome: Acetate and Cellulose—*u*, Silk—*hs*	1, 2, 3 Afterchrome: Acetate—*s*, Cotton—*vss*, Silk—*hs*	DYEING: WOOL Staining other fibres
	Silk: Afterchrome	Silk: Afterchrome, Mordant	DYEING: OTHER FIBRES
			PRINTING
ISO Wool (1) 3 –/2 5 3–4 4 5 3 4 5 4 — 1–2 4–5 3–4 5 4 4–5 5 — Strong change Strong change —	AATCC Wool (1) 4 — 4 — — 3 — 5 — 1 — 3 5 4 5 5 4 — 2 Bluer Duller Sol. cold, very sol. hot water	ISO Wool (3) 4–5 –/3–4 4 — — 4–5 1 4 4–5 4–5 — — 4–5 4 — — — 5 Poor 4–5 2 —	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
			NON-TEXTILE USAGE
	In substance: H_2SO_4 conc.—blue, on diln—red. HNO_3 conc.—red, turning orange		REACTIONS
			NOTES

C.I. Mordant Green	41	42
CHEMICAL CLASS	Monoazo	Disazo
C.I. CONSTITUTION NUMBER		
HUE: Daylight	Dull Green	Dull Bluish Green
Artificial light (tungsten)	Duller	Yellower
DYEING: WOOL	1, 2	1, 3
Staining other fibres	Metachrome: Acetate and Cellulose—*u*, Nylon—*d*, Silk—*hs*	Afterchrome: Acetate and Cellulose—*u*, Nylon and Silk—*hs*
DYEING: OTHER FIBRES		
PRINTING		
FASTNESS PROPERTIES ETC.		
Method	AATCC	AATCC
Substrate	Wool (2)	Wool (1)
Alkali	5	4–5
Cross Dyeing Wool Acetic/Sulphuric	—	—
Carbonising	3–4	5
Chlorination	—	—
Decatising	5	—
Hot Pressing	5	3
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	5	—
normal	6	5
2× normal	7	—
Milling: Alkaline	4	1
Acid	—	—
Peroxide Bleaching	4	3
Perspiration	5	5
Potting	4	4
Sea Water	5	5
Stoving	3	4
Washing	5	3
Water	5	—
Dischargeability	Not dischargeable	2
Metal in dyebath: Copper	Slightly duller	No change
Iron	Redder and duller	No change
Solubility	Soluble in cold and hot water	Sol. cold, very soluble in hot water
NON-TEXTILE USAGE		Leather: On chrome and vegetable tannages
REACTIONS	In substance: H_2SO_4 conc.—reddish violet, on diln—paler. On wool: HNO_3 conc.—bright yellowish green to olive	In substance: H_2SO_4 conc.—green, on diln—lavender ppt. HNO_3 conc.— purplish turning reddish grey
NOTES		

43	44	45	C.I. Mordant Green
Monoazo *	Azo	Azo	CHEMICAL CLASS C.I. CONSTITUTION NUMBER
Green Slightly yellower	Dull Green Little change	Dull Green Little change	HUE: Daylight Artificial light (tungsten)
1 Afterchrome: Acetate, Cellulose and Silk—*u*, Nylon—*hs*			DYEING: WOOL Staining other fibres
	Silk: Chromium lactate mordant Cotton: Pad with chromium acetate	Cotton: Pad with chromium acetate Silk: Chromium lactate	DYEING: OTHER FIBRES
	Wool and Silk: Chromium lactate Cotton: Chromium acetate	Cotton: Chromium acetate Silk and Wool: Chromium lactate	PRINTING
AATCC Wool (1) 5 — 4 — 3 5 — 6–7 — 4–5 — 3–4 5 4 5 4 4–5 —	ISO Cotton / Silk — — — — 4* — — — — — 3 4 3–4 4–5 4 5 — 3–4 — — — — — 3–4 — — — — — — † 5 — —	ISO Cotton / Silk — — — — — — 4* — — — — — 3 4 3–4 4–5 4 5 — 3–4 — — — — — 3–4 — — — — — — — — † 5	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water
3 Destroyed Destroyed Soluble in cold, very sol. in hot water	Dischargeable to white — — —	Dischargeable to white — — —	Dischargeability Metal in dyebath: Copper Iron Solubility
Leather: On chrome tannage dyes plum			NON-TEXTILE USAGE
In substance: H_2SO_4 conc.— yellowish red, on diln—bluish red ppt			REACTIONS
*Preparation: Nitroamidophenol→ H acid	*Chlorine †3–4 (40°C), 2 (100°C)	*Chlorine †3–4 (40°C), 2 (100°C)	NOTES

C.I. Mordant Green	46	47	48
CHEMICAL CLASS	Azo	Azo	
C.I. CONSTITUTION NUMBER			
HUE: Daylight	Bright Green	Bright Green	Dull Green
Artificial light (tungsten)	Little change	Little change	Little change
DYEING: WOOL			
Staining other fibres			
DYEING: OTHER FIBRES	Cotton: Pad with chromium acetate	Silk: Chromium lactate Cotton: Pad with chromium acetate	Cotton: Pad with chromium acetate
PRINTING	Wool and Silk: Chromium lactate Cotton: Chromium acetate	Wool and Silk: Chromium lactate Cotton: Chromium acetate	Wool and Silk: Chromium acetate
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Cotton	Cotton / Silk	Cotton
Alkali	—	— / —	—
Cross Dyeing Wool Acetic/Sulphuric	—	— / —	—
Carbonising	—	— / —	—
Chlorination	2–3*	4* / —	3*
Decatising	—	— / —	—
Hot Pressing	—	— / —	—
Light: ⅓–½ normal	—	3 / 3–4	4–5
normal	4–5	4 / 5	5
2× normal	5	5 / 5–6	6
Milling: Alkaline	—	— / 4–5	—
Acid	—	— / —	—
Peroxide Bleaching	—	— / —	—
Perspiration	—	— / 5	—
Potting	—	— / —	—
Sea Water	—	— / —	—
Stoving	—	— / —	—
Washing	2–3	4(40°C), 3(100°C) / 5	4(40°C), 2–3(100°C)
Water	—	— / —	—
Dischargeability	Not dischargeable	Dischargeable to white	Not dischargeable
Metal in dyebath: Copper	—	—	—
Iron	—	—	—
Solubility	—	—	—
NON-TEXTILE USAGE			
REACTIONS			
NOTES	*Chlorine	*Chlorine	*Chlorine

49	50	C.I. Mordant Green
Azo		CHEMICAL CLASS
		C.I. CONSTITUTION NUMBER
Dull Green	Bright Green	HUE: Daylight
Little change		Artificial light (tungsten)
		DYEING: WOOL
		Staining other fibres
Cotton: Pad with chromium acetate		DYEING: OTHER FIBRES
Wool and Silk: Chromium lactate Cotton: Chromium acetate		PRINTING
ISO Cotton — — — 3* — — 4 4–5 5 — — — — — — — 4 (40°C) 2 (100°C) — Dischargeable to white — — —		FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
	Anodised aluminium. Fastness: Light 7; Weather, very good; Heat (*a*) 6 h at 200°C little deeper; (*b*) 1 h at 250°C little deeper	NON-TEXTILE USAGE
		REACTIONS
*Chlorine		NOTES

C.I. Mordant Green	51	52	53
CHEMICAL CLASS		Monoazo	Disazo
C.I. CONSTITUTION NUMBER		18092	
HUE: Daylight	Dull Green	Dull Bluish Green	Olive
Artificial light (tungsten)		Unchanged	Practically unchanged
DYEING: WOOL		1	1
Staining other fibres		Afterchrome: Acetate—*ss*, Cotton—*hs*, Silk—*hs*	Afterchrome: Acetate—*u*, Cotton—*ss*, Silk—*hs*, Viscose—*u*
DYEING: OTHER FIBRES			
PRINTING			
FASTNESS PROPERTIES ETC.			
Method		ISO	ISO
Substrate		Wool (1)	Wool (1)
Alkali		5	4 (redder)
Cross Dyeing Wool Acetic/Sulphuric		—	—
Carbonising		4	4–5
Chlorination		—	3–4
Decatising		4	5
Hot Pressing		4	—
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal		4	5–6
normal		5	6
2× normal		6	7
Milling: Alkaline		4–5	4
Acid		—	3
Peroxide Bleaching		2–3	2
Perspiration		4–5	5
Potting		4	4
Sea Water		4–5	5
Stoving		3–4	3 (bluer)
Washing		4	4
Water		4–5	—
Dischargeability		—	—
Metal in dyebath: Copper		3	3–4
Iron		2	2 (redder)
Solubility		Very good	—
NON-TEXTILE USAGE	Anodised aluminium. Fastness: Light 6; Weather, fairly good; Heat (*a*) 6 h at 200°C much weaker; (*b*) 1 h at 250°C much weaker		
REACTIONS			In substance: H_2SO_4 conc.—olive, on diln—weaker
NOTES			

54	C.I. Mordant Green
Azo Phthalocyanine	CHEMICAL CLASS C.I. CONSTITUTION NUMBER
Bright Green	HUE: Daylight Artificial light (tungsten)
	DYEING: WOOL Staining other fibres
Silk: Cr mordant Cellulose: Dyed from Glauber's salt and then chromed or pad with chromium acetate or chromate	DYEING: OTHER FIBRES
Silk, Wool or Cellulose: Chromate or chromium acetate	PRINTING
ISO Silk — — — — — — — 6 — — — — 5 — — — 5 — Neutral and alkaline, very good — — Good	ISO Cellulose — — — — — — — 6 — — — — 5 — — — 5 —	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
Paper, very good fastness to light	NON-TEXTILE USAGE
	REACTIONS
	NOTES

C.I. Mordant Brown	1	2	3
CHEMICAL CLASS	Disazo	Disazo	
C.I. CONSTITUTION NUMBER	20110		
HUE: Daylight	Dull Reddish→Deep Brown	Dull Reddish Brown→Brown	Reddish Brown
Artificial light (tungsten)	Yellower	Yellow	
DYEING: WOOL	1, 2, 3		
Staining other fibres	Afterchrome: Acetate and Cellulose—*ss–hs* Metachrome: Acetate and Cellulose—*ss–hs*, Nylon—*d* Mordant: Acetate—*hs*, Cellulose—*ss*, Silk—*vhs*	Slightly different chemically from C.I. Mordant Brown 1 but very similar in application and fastness properties	
DYEING: OTHER FIBRES	Silk: Afterchrome, Metachrome Nylon: Afterchrome, 90–120 min boil needed for lake formation		
PRINTING	Wool: Cr mordant Cotton: Chromium acetate Vigoureux printing		Wool and Cotton: Chromium acetate

FASTNESS PROPERTIES ETC.

Method	AATCC	ISO	ISO	ISO	ISO
Substrate	Wool(2)	Wool(1)	Wool(2)	Wool(3)	Cotton
Alkali	5	4–5	4–5	4–5	—
Cross Dyeing Wool Acetic/Sulphuric	4/3	3–4/3–4	4/4	3–4/3	—
Carbonising	3–4	4	4	3	—
Chlorination	—	3–4	4	3	2*
Decatising	4	4–5	4–5	4–5	—
Hot Pressing	4–5	4–5	4–5	5	—
Light: ⅓–½ normal	4	4	4	4	2
normal	5	4–5	4–5	4–5	3
2× normal	6	5–6	5–6	5	4
Milling: Alkaline	4	4	4	4	—
Acid	—	3	3	2	—
Peroxide Bleaching	2–3	2–3	2–3	2	—
Perspiration	5	4–5	4–5	5	—
Potting	3–4	4–5	4	5	—
Sea Water	5	4–5	5	5	—
Stoving	3–4	2–3	2–3	2–3	—
Washing	4–5	4	5	5	3–4
Water	5	5	4–5	5	—
Dischargeability	Not dischargeable 4				5
Metal in dyebath: Copper	Redder				—
Iron	Yellower				—
Solubility	Soluble in cold and hot water				—

NON-TEXTILE USAGE	See Leather Dyes section Loose wool, fur and hat bodies, borax clearing 5		
REACTIONS			
NOTES	Fastness on Dyed Silk, ISO: (Afterchrome) Light 6–7, Peroxide bleaching 1, Perspiration 4, Stoving 4, Washing 4 (Mordant) Light 6–7, Peroxide bleaching 1, Perspiration 2, Stoving 3, Washing 3–4		*Chlorine

C.I. Mordant Brown	4	5	6
CHEMICAL CLASS	Monoazo	Disazo	Monoazo
C.I. CONSTITUTION NUMBER	**11335**		**11875**
HUE: Daylight	Dull Reddish Brown	Dull Reddish Brown	Dull Greenish→Deep Brown
Artificial light (tungsten)	Yellower and duller	Yellower and duller	Redder
DYEING: WOOL	1, 2, 3	Similar to C.I. Mordant Brown 4	1, 2, 3
Staining other fibres	Metachrome: Acetate, Cellulose and Silk—*ss–hs*, Nylon—*hs*		Afterchrome: Acetate—*ss*, Cellulose—*vss* Metachrome: Acetate—*ss*, Cotton—*vss*, Silk—*ss–hs*, Viscose—*u–ss* Mordant: Acetate and Cellulose—*ss*
DYEING: OTHER FIBRES	Silk: Afterchrome, Mordant Nylon: Afterchrome	Similar to C.I. Mordant Brown 4	Silk: Afterchrome, Mordant Nylon: Afterchrome
PRINTING	Vigoureux printing	Similar to C.I. Mordant Brown 4	Vigoureux printing
FASTNESS PROPERTIES ETC.			
Method	AATCC	ISO	ISO	ISO
Substrate	Wool (2)	Wool (2)*	Wool (2)*	Wool (2)*
Alkali	5	4	—	4–5
Cross Dyeing Wool Acetic/Sulphuric	4/4	3/2	4/3	4/4
Carbonising	5	2–3	1	4
Chlorination	—	5	4–5	4
Decatising	5	4–5	5	4–5
Hot Pressing	dry 3, wet 5	4–5	4	4–5
Light: ⅓–½ normal	3	4	4	3–4
normal	5–6	5	5	4
2× normal	6	6	5–6	4–5
Milling: Alkaline	4	4–5	5	4–5
Acid	—	1–2	1	3–4
Peroxide Bleaching	3	2	2–3	3
Perspiration	3–4	4–5	5	5
Potting	3	4–5	5	3–4
Sea Water	5	5	4	4–5
Stoving	4	3	4	4–5
Washing	4	4–5	4–5	4–5
Water	5	5	5	5
Dischargeability	4		—	—
Metal in dyebath: Copper	Much weaker		1	No change
Iron	Much redder and duller		4–5	Slight change
Solubility	—		—	—
NON-TEXTILE USAGE	Leather: On chrome tannage			See Leather Dyes section Loose fur and hat bodies, borax clearing 5
REACTIONS				
NOTES	*Wool (1) and (3) similar	*Wool (1) and (3) similar	*Wool (1) and (3) similar

7	8	9	C.I. Mordant Brown
Naphthoquinone 57030			CHEMICAL CLASS C.I. CONSTITUTION NUMBER
Reddish Brown Redder	Bright Reddish Brown Little change	Brown Unaffected	HUE: Daylight Artificial light (tungsten)
1 Acetate—*u–ss* Cellulose—*u–ss* Silk—*ss–hs*	1, 2, 3 All three methods: Acetate—*u*, Cellulose—*ss*	1 Acetate and Silk—*hs* Cellulose—*ss*	DYEING: WOOL Staining other fibres
	Silk: Afterchrome, Metachrome, Mordant Nylon: Afterchrome		DYEING: OTHER FIBRES
	Vigoureux printing		PRINTING
ISO Wool (1) 3–4 –/2 4–5 4 3–4 4 5 5–6 6 5 — 2 5 4 5 4 5 5 Not dischargeable Yellower Destroyed —	Wool (1)* — — — — — — 4–5 5 6 4–5 — 4 — — 5 3–4 — — Not dischargeable 5 4 Poor in cold, very good in hot water	ISO Wool (1) 4 –/1–2 2–3 4 4 4–5 4–5 5 5–6 4–5 — 2 5 3 5 5 5 4–5 — 4 3 —	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
Biological stain	See Leather Dyes section	Leather: used as an acid dye	NON-TEXTILE USAGE
	In substance: H_2SO_4 conc.—greenish grey		REACTIONS
	*Wool (2) and (3) similar	Very similar in properties to but not identical with C.I. Mordant Brown 33	NOTES

C.I. Mordant Brown	10	11	12
CHEMICAL CLASS		Monoazo	Monoazo
C.I. CONSTITUTION NUMBER		13295	11290
HUE: Daylight	Reddish Brown		Dull Reddish Brown
Artificial light (tungsten)	Somewhat redder		Redder
DYEING: WOOL		2	1, 2, 3. Metachrome: start dyeing at 160°F
Staining other fibres		Acetate—*hs* Cellulose—*hs* Silk—*hs*	Afterchrome and Mordant: Acetate and Cellulose—*s* Metachrome: Acetate, Cellulose and Silk—*ss–hs*
DYEING: OTHER FIBRES			Silk: Afterchrome, Mordant Nylon: Afterchrome
PRINTING	Wool, Silk and Cotton: Cr mordant		Wool and Silk: Cr mordant Vigoureux printing
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Cotton	Wool (2)	Wool (2)*
Alkali	—	4–5	4–5
Cross Dyeing Wool Acetic/Sulphuric	—	—	3/2–3
Carbonising	—	3–4	1
Chlorination	3–4*	—	4–5
Decatising	—	5	5
Hot Pressing	—	4	4
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	—	4	4
normal	3	4–5	5
2× normal	4	5–6	5–6
Milling: Alkaline	—	4	5
Acid	—	—	1
Peroxide Bleaching	—	1	2
Perspiration	—	5	5
Potting	—	4	4
Sea Water	—	5	4
Stoving	—	4	2
Washing	4	4	4
Water	—	5	5
Dischargeability	—	—	—
Metal in dyebath: Copper	—	Unchanged	1
Iron	—	Unchanged	5
Solubility	—	—	Not in complete soln below 160°F
NON-TEXTILE USAGE			See Leather Dyes section
REACTIONS			
NOTES	*Chlorine	Requires one-and-a-half times its weight of metachrome mordant	*Wool (1) and (3) similar Best dyed metachrome

13	14	15	C.I. Mordant Brown
Monoazo	Monoazo	Monoazo	CHEMICAL CLASS
13225	13310	14870	C.I. CONSTITUTION NUMBER
Dull Reddish Brown Redder	Reddish Brown Slightly redder	Reddish Brown Brighter, slightly yellower	HUE: Daylight Artificial light (tungsten)
1, 2, 3 Afterchrome: Acetate—*ss*, Cellulose—*ss–hs*	1 Acetate—*ss–s* Cotton—*u–vss* Silk–*hs* Viscose—*u*	1, 2, 3 Afterchrome: Acetate—*u–vss*, Cellulose—*u–vss* Nylon—*d* Silk—*ss–d*	DYEING: WOOL Staining other fibres
Silk: Afterchrome Nylon: Afterchrome using formic acid	Silk: Afterchrome, Mordant	Silk: Afterchrome Nylon: Afterchrome	DYEING: OTHER FIBRES
Wool: Chromium acetate Vigoureux printing	Wool: Chromium acetate Vigoureux printing	Wool: Cr mordant Vigoureux printing	PRINTING
AATCC Wool(1) / ISO Wool(1) / ISO Wool(3) 4–5 / 5 / 4 4/2 / 4/3 / 2/1 5 / 5 / 2–3 — / 5 / 4 3 / 4–5 / 3 5 / 4–5 / 3–4 5 / 4–5 / 4–5 6–7 / 5 / 5 7 / 5–6 / 5–6 3–4 / 3–4 / 2–3 — / 2 / 2 1 / 1 / 2 4 / 5 / 4 4 / 3 / 2 5 / 5 / 4–5 4 / 2–3 / 2 4 / 4–5 / 4–5 5 / 5 / 5 Not dischargeable Yellower and weaker Yellower, duller and weaker Moderate	ISO Wool (1) 5 –/4 5 — 5 5 4–5 5 5–6 5 1 2 5 3–4 5 4 4–5 5 — Redder and weaker Redder Suitable for package dyeing	AATCC Wool (1) / ISO Wool (1) 5 / 5 — / 3/3–4 5 / 5 — / 3–4 4–5 / 4–5 5 / 5 5 / 5–6 6 / 6 7 / 7 4–5 / 5 — / 4 2–3 / 3–4 5 / 4–5 3 / 2–3 5 / 5 5 / 4–5 4–5 / 5 — / 5 Dischargeable to white Much altered Very much altered —	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
Leather: On chrome tannage	Loose fur and hat bodies, borax clearing 5	Leather: On chrome and vegetable tannages Loose wool, fur and hat bodies, borax clearing 5	NON-TEXTILE USAGE
		In substance: H_2SO_4 conc. —brownish red, on diln— brownish orange ppt.	REACTIONS
Metachrome dyeings are duller and yellower than afterchrome dyeings			NOTES

C.I. Mordant Brown	16	17	
CHEMICAL CLASS	Monoazo	Monoazo	
C.I. CONSTITUTION NUMBER			
HUE: Daylight	Brown	Bluish Brown	
Artificial light (tungsten)	Slightly redder	Much redder	
DYEING: WOOL	1, 2, 3	1	
Staining other fibres	Afterchrome: Acetate—*u*, Cellulose—*u*	Acetate—*ss–hs* Cellulose—*u* Silk—*ss–hs*	
DYEING: OTHER FIBRES	Silk: Afterchrome Nylon: Afterchrome	Nylon: Afterchrome	
PRINTING			
FASTNESS PROPERTIES ETC.			
Method	AATCC	AATCC	ISO
Substrate	Wool (1)	Wool (1)	Wool (1)
Alkali	4	4–5	5
Cross Dyeing Wool Acetic/Sulphuric	—	3/3	3/1
Carbonising	5	5	5
Chlorination	—	—	4
Decatising	4	4–5	4–5
Hot Pressing	5	4–5	3–4
Light: ⅓–½ normal	—	5	6
normal	4	6–7	6–7
2× normal	—	7	7
Milling: Alkaline	4	4–5	4–5
Acid	—	—	—
Peroxide Bleaching	2	2–3	3–4
Perspiration	5	4–5	5
Potting	3	3–4	4
Sea Water	5	5	5
Stoving	—	3–4	4–5
Washing	5	4–5	5
Water	—	5	5
Dischargeability	3	—	
Metal in dyebath: Copper	Unaltered	Appreciably redder	
Iron	Unaltered	Dull reddish brown	
Solubility	Very soluble in cold and hot water	Slightly soluble in cold, soluble in hot water	
NON-TEXTILE USAGE			
REACTIONS	In substance: H_2SO_4 conc.—bordeaux, on diln—brown ppt	In substance: H_2SO_4 conc.—yellowish red, on diln—changed; HCl conc.—violet	
NOTES			

18	18:1	19	C.I. Mordant Brown
Disazo	Disazo	Monoazo	CHEMICAL CLASS
20150		14250	C.I. CONSTITUTION NUMBER
Yellowish Brown Redder and brighter	Yellowish Brown Redder and brighter	Reddish Brown Redder	HUE: Daylight Artificial light (tungsten)
1, 2, 3 Afterchrome: Acetate—*ss–hs*, Cellulose—*u–hs*, Silk—*hs*	— Slightly different chemically from but similar in properties and uses to C.I. Mordant Brown 18	1, 2, 3 Afterchrome: Acetate—*vss–hs*, Cellulose—*u–ss* Metachrome: Acetate—*u*, Cellulose—*u*	DYEING: WOOL Staining other fibres
Nylon: Afterchrome, Metachrome		Silk: Afterchrome Nylon: Afterchrome	DYEING: OTHER FIBRES
Wool: Cr mordant		Wool: Cr mordant Vigoureux printing	PRINTING
AATCC Wool (1) / ISO Wool (1) 4–5 / 4 — / –/1 3–4 / 3 — / — — / 4 5 / 4 4 / 4 4 / 4–5 5 / 5 4 / 3–4 — / — 1 / 2–3 4–5 / 4 4–5 / 3 4 / 4 1 / 3–4 4 / 4 5 / 5 — Duller Destroyed —		AATCC Wool (1) / ISO Wool (1) / ISO Wool (2)* 5 / 4–5 / 4 –/3 / 5/4 / 4/4 3 / 4 / 4 — / 4–5 / 4–5 5 / 4–5 / 4–5 3–4 / 4 / 3–4 5 / 5–6 / 5–6 6 / 6–7 / 6–7 7 / 7 / 7 4 / 5 / 4–5 — / 2–3 / 3 4 / 4 / 4 5 / 5 / 5 3–4 / 4 / 3–4 5 / 5 / 5 5 / 4–5 / 4–5 4 / 5 / 5 5 / 5 / 5 — Redder Much yellower —	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
Biological stain Leather		Leather: On chrome tannage, especially used for gloving leather	NON-TEXTILE USAGE
			REACTIONS
		*Wool (3) similar Fastness on dyed silk (ISO): Hot-pressing 4–5; Light 6, 6, 6–7; Peroxide bleaching 3; Perspiration 5; Washing 4; Water 5	NOTES

C.I. Mordant Brown	20	21	22	
CHEMICAL CLASS		Monoazo	Monoazo	
C.I. CONSTITUTION NUMBER		19600	14235	
HUE: Daylight	Reddish Brown	Reddish Brown	Dull Brown	
Artificial light (tungsten)		Little change	Little change	
DYEING: WOOL		1, 2, 3	1, 3	
Staining other fibres	Slightly different chemically from C.I. Mordant Brown 19 but has the same fastness properties and usage	Afterchrome and Metachrome: Acetate—*u–ss*, Cellulose—*u*, Silk—*s*	Afterchrome: Acetate—*u–hs*, Cellulose—*u*	
DYEING: OTHER FIBRES			Silk: Afterchrome Nylon: Afterchrome	
PRINTING			Wool: Chromium acetate	
FASTNESS PROPERTIES ETC.				
Method		ISO	AATCC	ISO
Substrate		Wool (1)	Wool (1)	Wool (1)
Alkali		4–5	4–5	4–5
Cross Dyeing Wool Acetic/Sulphuric		–/4–5	—	—
Carbonising		5	3	4
Chlorination		—	—	—
Decatising		4–5	4	4
Hot Pressing		4–5	4	4
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal		6	5	5
normal		6–7	6	5–6
2× normal		7	7	6
Milling: Alkaline		5	4	3–4
Acid		4–5	—	3
Peroxide Bleaching		4–5	3–4	3
Perspiration		4–5	5	5
Potting		4–5	3	3–4
Sea Water		5	5	4
Stoving		5	2	2
Washing		5	4	4
Water		5	—	—
Dischargeability		—	—	
Metal in dyebath: Copper		3–4	Redder	
Iron		2–3	Much yellower	
Solubility		Good	—	
NON-TEXTILE USAGE			Leather: On chrome tannage	
REACTIONS				
NOTES				

23	24	C.I. Mordant Brown
Azo	Monoazo	CHEMICAL CLASS
	11880	C.I. CONSTITUTION NUMBER
Greenish Grey→Deep Yellowish Brown Greener	Brownish Olive→Yellowish Brown Redder	HUE: Daylight Artificial light (tungsten)
1, 2 Afterchrome: Acetate—*vss*, Cotton—*vss*, Silk—*hs*	1, 2, 3 Afterchrome: Acetate—*u*, Cellulose—*u*, Nylon 6—*s*, Silk—*ss* Metachrome: Acetate—*ss–s*, Cotton—*u–s*, Silk—*ss–vhs*, Viscose—*u–ss*	DYEING: WOOL Staining other fibres
	Silk: Afterchrome, Mordant Nylon: Afterchrome	DYEING: OTHER FIBRES
		PRINTING
AATCC Wool (1) / ISO Wool (1)* — / 5 — / –/5 5 / 4 4–5 / — 5 / 5 / 5 — / 6 4–5 / 6–7 — / 7 4 / 4 — / 5 — / — 5 / 5 3–4 / 5 5 / — — / 5 — / 4–5 — / — 2 5 3–4 —	ISO Wool (1) / Wool (2)† 4–5 / 4–5 5/4–5 / 5/4–5 5 / 5 4–5 / 4–5 4–5 / 4–5 4–5 / 4–5 5 / 5–6 6 / 6 7 / 7 5 / 4–5 3–4 / 4 4 / 4 5 / 4–5 4–5 / 4–5 4–5 / 4 4–5 / 4–5 5 / 4–5 5 / 5 Dischargeable to white 1 3–4 —	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
	Anodised aluminium Lake making See Leather Dyes section Wool and fur skins*	NON-TEXTILE USAGE
	On wool: H_2SO_4 conc.—reddish brown	REACTIONS
*Wool (2) very similar	*Loose wool and fur for hats, borax clearing 5 †Wool (3) similar	NOTES

C.I. Mordant Brown	25	26	27
CHEMICAL CLASS	Monoazo	Triphenylmethane	Azo
C.I. CONSTITUTION NUMBER	13305	44525	
HUE: Daylight	Yellowish Brown	Reddish Brown	Dull Reddish Brown
Artificial light (tungsten)	Little change	Unaltered	Slighly redder
DYEING: WOOL	2	1	1
Staining other fibres	Acetate—*u* Cellulose—*ss* Silk—*hs*	Acetate—*s* Cellulose—*u*	Acetate—*vss* Cotton—*u* Silk—*ss*
DYEING: OTHER FIBRES		Silk: Afterchrome Cotton: On discharged Cr mordant	
PRINTING	Wool: Chromium acetate Vigoureux printing	Wool, Silk and Cotton: Cr mordant	Wool: Cr mordant Vigoureux printing
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Wool (2)	Wool (1) / Silk / Cotton	Wool (1)
Alkali	4	3 / — / —	4–5
Cross Dyeing Wool Acetic/Sulphuric	—	— / — / —	–/4
Carbonising	4	5 / — / —	5
Chlorination	—	— / — / 3*	—
Decatising	3	5 / — / —	5
Hot Pressing	3	4 / 2–3 / —	3–4
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	4	4 / — / —	5
normal	4–5	4–5 / 4 / 4–5	6
2× normal	5	5 / — / —	6–7
Milling: Alkaline	4	3–4 / 3 / —	4–5
Acid	2	3 / — / —	4
Peroxide Bleaching	2–3	1 / 1 / —	—
Perspiration	4–5	5 / 5 / —	5
Potting	3–4	4–5 / — / —	4–5
Sea Water	4	5 / — / —	—
Stoving	3	4 / 3 / —	4
Washing	4	4 / 5 / 4	4–5
Water	4–5	5 / 5 / —	—
Dischargeability	—	Dischargeable to white	4–5
Metal in dyebath: Copper	3–4	3	3
Iron	4–5	3	2
Solubility	—	—	—
NON-TEXTILE USAGE		Loose fur and hat bodies, borax clearing 5	
REACTIONS			
NOTES		*Chlorine	

28	29	30	C.I. Mordant Brown
	Disazo	Monoazo	CHEMICAL CLASS
		13230	C.I. CONSTITUTION NUMBER
Reddish Brown Yellower	Reddish Brown Redder	Dull Reddish Brown Little change	**HUE:** Daylight Artificial light (tungsten)
	1, 2, 3 Afterchrome: Acetate—*u*, Cotton—*hs*, Viscose—*u* Metachrome: Acetate—*hs*, Cotton—*hs*, Viscose—*ss*	1, 3 Afterchrome: Acetate—*ss*, Cellulose—*ss–hs*	**DYEING: WOOL** Staining other fibres
	Silk: Afterchrome, Mordant Nylon: Afterchrome, 90 min boil	Silk: Afterchrome	**DYEING: OTHER FIBRES**
Wool and Silk: Cr mordant, steam 30–60 min Cotton: Cr mordant, steam 5–7 min	Wool: Cr mordant Silk: Cr mordant Vigoureux printing	Wool: Chromium acetate Vigoureux printing	**PRINTING**

ISO Cotton	ISO Wool (1)	ISO Wool (2)*	ISO Wool (1)	ISO Silk	**FASTNESS PROPERTIES ETC.**
—	—	—	4–5	—	Method
—	3/2	3/2	–/1–2	—	Substrate
—	4	2	3–4	—	Alkali
4–5*	5	5	—	—	Cross Dyeing Wool Acetic/Sulphuric
—	5	4–5	4–5	—	Carbonising
					Chlorination
					Decatising
—	3	3	5	3–4	Hot Pressing
—	4–5	4–5	4–5	—	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
—	5	5	5	5	normal
—	5	5	5–6	—	2× normal
—	4	4–5	5	5	Milling: Alkaline
—	3	2–3	4	—	Acid
—	2	2	2	2	Peroxide Bleaching
—	5	5	4–5	5	Perspiration
—	3	4	4	—	Potting
—	5	5	4	—	Sea Water
—	3	2–3	3–4	5	Stoving
4	4	5	5	5	Washing
—	5	5	5	5	Water
2–3	Not dischargeable		—		Dischargeability
—	5		Redder		Metal in dyebath: Copper
—	5		Much weaker		Iron
—	Suitable for package dyeing		—		Solubility
	Anodised aluminium See Leather Dyes section		Anodised aluminium Leather		**NON-TEXTILE USAGE**
	In substance: H_2SO_4 conc. —green				**REACTIONS**
*Chlorine	*Wool (3) similar				**NOTES**

C.I. Mordant Brown	31	32	33
CHEMICAL CLASS	Monoazo		Monoazo
C.I. CONSTITUTION NUMBER			13250
HUE: Daylight	Reddish Brown		Yellowish Brown
Artificial light (tungsten)	Brighter and yellower		Redder
DYEING: WOOL	1, 2, 3	This C.I. generic name is discontinued, dyes formerly listed under it now appear under C.I. Mordant Brown 24	1, 2, 3
Staining other fibres	Afterchrome: Acetate—*hs* Cellulose—*hs*		Afterchrome: Acetate and Cellulose—*u–hs* Metachrome: Acetate—*u–vss*, Cellulose—*vss–ss*. Nylon—*d*, Silk—*hs* Mordant: Acetate and Cellulose—*vss–ss*
DYEING: OTHER FIBRES	Silk: Afterchrome Nylon: Afterchrome (high substantivity)		Silk: Afterchrome, Mordant Nylon: Afterchrome, 90–120 min boil for lake completion
PRINTING	Wool: Cr mordant Silk: Cr mordant		Wool: Cr mordant Silk: Cr mordant Vigoureux printing

FASTNESS PROPERTIES ETC.

Method	ISO		AATCC	ISO	ISO	AATCC
Substrate	Wool (1)*		Wool (1)	Wool (1)	Wool (3)	Nylon
Alkali	3–4		5	4	—	—
Cross Dyeing Wool Acetic/Sulphuric	4/3		2–3/1	2–3/1	3/1	—
Carbonising	5		3	2	2	—
Chlorination	5		—	4–5	4	—
Decatising	4–5		3–4	4	4	5*
Hot Pressing	4–5		5	4	5	wet 5
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	4		5	4–5	4–5	—
normal	4–5		6	5	5	2–3
2× normal	5		7	5–6	5–6	—
Milling: Alkaline	4		4–5	4	3–4	4
Acid	4		—	1–2	1	—
Peroxide Bleaching	3		1–2	1–2	1	1
Perspiration	4–5		5	4–5	5	5
Potting	4		3	2–3	4	—
Sea Water	5		4	4–5	4–5	4
Stoving	4		4–5	4	2	—
Washing	4–5		4–5	4–5	4–5	4
Water	5		5	5	5	—
Dischargeability	—		Dischargeable to white			
Metal in dyebath: Copper	2		Much duller			
Iron	2		Yellower and duller			
Solubility	—		Sparingly sol. in cold, readily sol. in hot water			

NON-TEXTILE USAGE	See Leather Dyes section		See Leather Dyes section
REACTIONS			
NOTES	*Wool (3) similar		*Sublimation

34	35	36	C.I. Mordant Brown
Azo	Monoazo	Tetrakisazo	**CHEMICAL CLASS**
	14765	**35750**	**C.I. CONSTITUTION NUMBER**
Brown	Dull Reddish Brown		**HUE:** Daylight
Little change	Redder		Artificial light (tungsten)
	1, 2, 3	1	**DYEING: WOOL**
	Afterchrome: Acetate—*u–hs*, Cellulose—*u*	Acetate—*ss* Cellulose—*ss* Silk—*hs*	Staining other fibres
Silk: Chromium lactate Cotton: Pad with chromium acetate	Silk: Afterchrome Nylon: Afterchrome with formic acid		**DYEING: OTHER FIBRES**
Wool: Chromium lactate Silk: Chromium lactate Cotton: Chromium acetate	Wool: Chromium acetate or chromate		**PRINTING**

FASTNESS PROPERTIES ETC.

ISO Cotton	ISO Silk	AATCC Wool (1)	ISO Wool (1)	ISO Wool (1)	
—	—	5	5	3–4	Method
—	—	—	5/4	2–3/2	Substrate
—	—	5	4–5	4	Alkali
4–5*	—	—	4–5	4	Cross Dyeing Wool Acetic/Sulphuric
—	—	—	4–5	4	Carbonising
					Chlorination
—	—	wet 5	4	3–4	Decatising
4–5	5	—	5	5	Hot Pressing
5	5–6	7	5–6	5	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
5–6	6	—	6–7	5–6	normal
—	4–5	2	4–5	4	2× normal
—	—	—	2–3	5	Milling: Alkaline
—	—	4	3–4	—	Acid
—	4–5	5	5	2–3	Peroxide Bleaching
—	—	4	3–4	2–3	Perspiration
					Potting
—	—	5	5	3	Sea Water
—	—	5	4	4–5	Stoving
4 (40°C) 3–4 (100°C)	5	3	5	2	Washing
—	—	—	5	—	Water
Dischargeable to white		—		—	Dischargeability
—		Much redder		1–2	Metal in dyebath: Copper
—		Destroyed		2	Iron
—		—		—	Solubility
		Leather: On chrome tannage			**NON-TEXTILE USAGE**
		On wool: HNO_3 conc.—pale yellow, turning red			**REACTIONS**
*Chlorine					**NOTES**

C.I. Mordant Brown	37	38	39
CHEMICAL CLASS	Azo	Azo	Azo
C.I. CONSTITUTION NUMBER			
HUE: Daylight	Reddish Brown	Deep Yellowish Brown	Dull Brown
Artificial light (tungsten)	Little change	Little change	Little change
DYEING: WOOL	1, 3	1, 2	1
Staining other fibres	Afterchrome: Acetate—*s*, Cotton—*vss*, Viscose—*u*	Afterchrome: Acetate—*s*, Cotton—*u*, Silk—*hs*	Acetate—*u* Cotton—*s*
DYEING: OTHER FIBRES	Silk: Afterchrome, Metachrome		Silk: Afterchrome
PRINTING	Wool: Chromium fluoride Vigoureux printing	Wool: Cr mordant Vigoureux printing	
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Wool (1) / Wool (2)	Wool (1) / Wool (2)	Wool (1)
Alkali	4 / 5	5 / —	5
Cross Dyeing Wool Acetic/Sulphuric	–/4 / –/3	–/4 / —	4/3–4
Carbonising	3 / 4	3–4 / 4	3–4
Chlorination	5 / 5	— / 3	—
Decatising	4–5 / 4–5	5 / 5	—
Hot Pressing	4 / 4	5 / 4	4
Light: ⅛–½ normal	4–5 / 4–5	5–6 / 5–6	4–5
normal	5 / 5	6–7 / 6–7	5
2× normal	5–6 / 5–6	7 / 7	5–6
Milling: Alkaline	4 / 5	4 / 4	4–5
Acid	1 / 3–4	3 / —	—
Peroxide Bleaching	2 / 3	— / —	—
Perspiration	5 / 5	5 / 5	5
Potting	4–5 / 4	4–5 / 4–5	4–5
Sea Water	— / —	— / 5	—
Stoving	4 / 4–5	5 / —	3
Washing	4 / 4	4 / 4–5	—
Water	— / —	— / 5	5
Dischargeability	2	4	2–3
Metal in dyebath: Copper	3 (1), 4 (2)	3 (1), 4 (2)	4
Iron	3–4 (1 and 2)	2 (1), 4 (2)	3
Solubility	—	—	—
NON-TEXTILE USAGE			See Leather Dyes section
REACTIONS			
NOTES			

C.I. Mordant Brown

40	41	42	
Monoazo	Monoazo	Anthraquinone	**CHEMICAL CLASS**
17590	**14340**	**58200**	**C.I. CONSTITUTION NUMBER**
Dull Brown Duller and yellower	Reddish Brown Slightly brighter	Dull Brown Yellower	**HUE:** Daylight Artificial light (tungsten)
1, 2, 3 Afterchrome: Acetate—*u*, Cellulose—*ss*, Silk—*ss*		1, 3 Mordant: Acetate—*u–hs*, Cellulose—*ss–hs*, Nylon—*hs*, Silk—*ss–d*	**DYEING: WOOL** Staining other fibres
Nylon: Afterchrome		Nylon: Reduced Cr mordant	**DYEING: OTHER FIBRES**
Wool: Chromium fluoride or acetate Vigoureux printing	Wool: Cr mordant Cotton: Cr mordant Silk: Cr mordant	Wool: Cr mordant Silk: Cr mordant Cotton: Cr mordant Vigoureux printing. Illuminating colour in discharges	**PRINTING**

AATCC Wool (1)	ISO Wool (1)	ISO Wool	ISO Cotton	AATCC Wool (3)	ISO Wool (3)	**FASTNESS PROPERTIES ETC.**
3	5	—	—	2–3	3–4	Method
–/4	–/5	—	—	–/4	–/4–5	Substrate
5	5	—	—	4–5	2	Alkali
—	2–3	—	2*	—	2	Cross Dyeing Wool Acetic/Sulphuric
4	5	—	—	3	5	Carbonising
						Chlorination
dry 3, wet 5	5	—	—	dry 3, wet 5	5	Decatising
5	5	—	—	—	5	Hot Pressing
6	5–6	—	3	5	5–6	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
7	6	—	—	—	6	normal
4–5	5	—	—	2–3	3–4	2× normal
—	4	—	—	—	2–3	Milling: Alkaline
2	3–4	—	—	1	1	Acid
5	5	—	—	5	5	Peroxide Bleaching
4	4–5	—	—	4–5	5	Perspiration
						Potting
4	5	—	—	5	—	Sea Water
5	4	—	—	5	4	Stoving
4	5	4	3	4	5	Washing
5	5	—	—	5	5	Water
—				Poor		Dischargeability
Redder				Duller (1) 3 (3)		Metal in dyebath: Copper
Yellower and duller				Duller (1) 1–2 (3)		Iron
—				—		Solubility
Hat bodies, borax clearing 5				Leather: On chrome tannage		**NON-TEXTILE USAGE**
						REACTIONS
	*Chlorine			*Fastness on Printed Cotton, ISO: Chlorine 2–3; Light 5, 6, 7; Washing 4–5		**NOTES**

C.I. Mordant Brown	43	44	45
CHEMICAL CLASS	Anthraquinone	Anthraquinone	Azo
C.I. CONSTITUTION NUMBER		58020	
HUE: Daylight	Dull Brown	Dull Brown	Dull Reddish Brown
Artificial light (tungsten)	Yellower	Yellower	Little change
DYEING: WOOL			
Staining other fibres	Chemically slightly different from C.I. Mordant Brown 42 but very similar in properties and uses	Application, fastness properties and usages are practically identical with those of C.I. Mordant Brown 42	
DYEING: OTHER FIBRES			Cotton: Pad with chromium acetate
PRINTING			Wool: Chromium lactate Silk: Chromium lactate Cotton: Chromium acetate
FASTNESS PROPERTIES ETC.			
Method			ISO
Substrate			Cotton
Alkali			—
Cross Dyeing Wool Acetic/Sulphuric			—
Carbonising			—
Chlorination			3*
Decatising			—
Hot Pressing			—
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal			3
normal			4
2× normal			4–5
Milling: Alkaline			—
Acid			—
Peroxide Bleaching			—
Perspiration			—
Potting			—
Sea Water			—
Stoving			—
Washing			4 (40°C) 3–4 (100°C)
Water			—
Dischargeability			Dischargeable to white
Metal in dyebath: Copper			
Iron			
Solubility			
NON-TEXTILE USAGE			
REACTIONS			
NOTES		Formerly used as an intermediate in the manufacture of C.I. 60765	*Chlorine

46	47	48	C.I. Mordant Brown
Azo		Monoazo	CHEMICAL CLASS
		11300	C.I. CONSTITUTION NUMBER
Dull Reddish Brown Redder		Dull Reddish Brown Yellower	HUE: Daylight Artificial light (tungsten)
1, 2 Afterchrome: Acetate—*ss*, Cellulose—*ss*, Silk—*hs* Metachrome: Acetate—*s*, Cotton—*hs*, Viscose—*ss*	This C.I. generic name is discontinued; dyes formerly listed under it now appear under C.I. Mordant Brown 50	1, 2, 3 Afterchrome: Acetate—*hs*, Cotton—*ss*, Viscose—*s* Metachrome: Acetate—*hs*, Cellulose—*ss–hs*, Silk—*hs* Mordant: Acetate—*hs*, Cellulose—*ss–s*	DYEING: WOOL Staining other fibres
Silk: Metachrome, unweighted silk dyes to a less depth than wool, weighted silk dyes yellower than wool. Nylon: Afterchrome, needs chroming for 2 h		Silk: Basic chromium chloride Nylon: Afterchrome	DYEING: OTHER FIBRES
Vigoureux printing			PRINTING
ISO Wool (1) Wool (2) 5 5 — — 4 5 4 5 4–5 5 5 4–5 5–6 6–7 6 7 6 7–8 4–5 5 4–5 5 3–4 5 4–5 5 4–5 5 5 5 5 5 4–5 5 — — Dischargeable to white 3–4 (1) 5 (2) 1 (1) 5 (2) Excellent		ISO Wool (2)* 4 — 4 4 4–5 4 4 5 6 4–5 2–3 2 4–5 3 4–5 3–4 4–5 5 Dischargeable to white Yellower Redder Not in complete soln below 160°F	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
		See Leather Dyes section	NON-TEXTILE USAGE
			REACTIONS
		*Wool (1) and (3) similar	NOTES

C.I. Mordant Brown	49	50	51
CHEMICAL CLASS	Monoazo	Monoazo	Disazo
C.I. CONSTITUTION NUMBER	**13265**		**26530**
HUE: Daylight	Reddish Brown	Yellowish Brown	Reddish Brown
Artificial light (tungsten)	Little change	Slightly redder	Much yellower
DYEING: WOOL	1	1, 2, 3	1
Staining other fibres	Acetate—*u* Cellulose—*u*	Afterchrome: Acetate—*u–ss*, Cellulose—*u*, Silk—*hs* Metachrome: Acetate—*u*, Cellulose—*u*, Silk—*hs*	
DYEING: OTHER FIBRES	Silk: Afterchrome	Nylon: Afterchrome	
PRINTING			Wool: Cr mordant Silk: Cr mordant Cotton: Cr mordant Viscose: Cr mordant

FASTNESS PROPERTIES ETC.

Method	ISO		AATCC	ISO		ISO	
Substrate	Wool (1)	Silk	Wool (2)	Wool (1)	Wool (2)	Cotton	Viscose†
Alkali	4	—	4	4–5	4–5	1	1
Cross Dyeing Wool Acetic/Sulphuric	—	—	—	5/2–3	5/2–3	2–3	2
Carbonising	2–3	—	4–5	4–5	4–5	—	—
Chlorination	—	—	4–5	4	4	3–4*	—
Decatising	4	—	5	5	5	—	—
Hot Pressing	5	4	5	5	5	4–5	2
Light: ⅓–½ normal	4–5	—	5–6	5–6	5–6	—	—
normal	5	5–6	6	6	6	3–4	5
2× normal	5–6	—	7	6–7	6–7	—	—
Milling: Alkaline	4–5	3–4	5	5	4–5	—	—
Acid	2	—	—	—	—	—	—
Peroxide Bleaching	2	2	4	4	4	1	5
Perspiration	5	5	5	5	5	4	5
Potting	3	—	3–4	4	3–4	—	—
Sea Water	5	—	5	5	5	—	—
Stoving	4	5	5	5	5	—	—
Washing	5	3–5	5	5	5	3	4
Water	5	5	5	5	5	4–5	5
Dischargeability	—		Dischargeable to white			Dischargeable to white	
Metal in dyebath: Copper	Slightly duller and weaker		Strong change (1), unaltered (2)			Much bluer and duller	
Iron	Destroyed		Strong change (1), slight change (2)			—	
Solubility	—		Suitable for package dyeing			—	

NON-TEXTILE USAGE			
REACTIONS		In substance: H_2SO_4 conc.—chocolate brown, on diln—olive ppt.	
NOTES			*Chlorine †Fastness to resin finishing—bluer, Light fastness unaffected

52	53	54	C.I. Mordant Brown
Monoazo	Monoazo	Monoazo	CHEMICAL CLASS
		11965	C.I. CONSTITUTION NUMBER
Dull Yellowish Brown Yellower and brighter	Dull Reddish Brown Duller	Reddish Brown Brighter, less bluish	HUE: Daylight Artificial light (tungsten)
1, 2 Afterchrome and Metachrome: Acetate—*ss*, Cellulose—*u*, Silk—*ss*	1, 3 Afterchrome: Acetate—*u*, Cellulose—*u*, Silk—*ss*	3	DYEING: WOOL Staining other fibres
Nylon: Afterchrome, 90–120 min. boil			DYEING: OTHER FIBRES
Wool: Chromium acetate	Wool: Chromium acetate	Wool: Cr mordant Silk: Cr mordant Cotton: Cr mordant	PRINTING
ISO Wool (1) Wool (2) 5 5 –/3–4 –/3–4 5 5 5 5 4 4 — — 5 5–6 6 6 6–7 6–7 4–5 5 5 5 5 5 5 5 4–5 4–5 — — 5 5 5 5 5 5 Not dischargeable 2 (1 and 2) 2 (1) 4 (2) Moderate	ISO Wool (1) 4–5 –/5 5 4–5 5 — 4–5 5 6 4 3–4 3–4 4 3–4 — 5 5 5 Unsuitable for discharge work 1 1 Very good	ISO Wool (3) Cotton 2 — 3–4/2–3 — 3 — 2 3–4* 3 — 3–4 — 2 3 3 3 4 4 3 — 2 — 2 — 4 — 1 — 4 — 4 — 3–4 4 5 — — Slightly redder Sensibly redder —	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
			NON-TEXTILE USAGE
			REACTIONS
		*Chlorine	NOTES

C.I. Mordant Brown	55	56	57
CHEMICAL CLASS			Azo
C.I. CONSTITUTION NUMBER			
HUE: Daylight	Dull Reddish Brown	Reddish Brown	Bright Reddish Brown
Artificial light (tungsten)	Brighter and yellower	Unchanged	Much redder
DYEING: WOOL	1	1	1, 2, 3
Staining other fibres	Acetate—*hs* Cellulose—*hs* Silk—*d*	Acetate—*hs* Cellulose—*hs*	Afterchrome: Acetate—*u*, Cotton—*hs*, Silk—*hs*, Viscose—*u* Metachrome: Acetate—*ss*, Cotton—*hs*, Silk—*hs*, Viscose—*ss*
DYEING: OTHER FIBRES			
PRINTING			
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Wool (1)	Wool (1)	Wool (1) / Wool (2)*
Alkali	4	5	— / —
Cross Dyeing Wool Acetic/Sulphuric	—	—	3/2 / 3/2
Carbonising	2	5	4 / 2
Chlorination	—	—	5 / 5
Decatising	5	5	5 / 5
Hot Pressing	4–5	3–4	3 / 3
Light: ½–½ normal	3	—	4–5 / 4–5
normal	3	7	5 / 5
2× normal	3–4	—	5 / 5
Milling: Alkaline	3–4	5	4 / 4–5
Acid	—	—	3 / 2
Peroxide Bleaching	—	—	2 / 2
Perspiration	5	5	5 / 5
Potting	4	—	3 / 4
Sea Water	4	5	5 / 5
Stoving	3	5	3 / 2–3
Washing	4	5	4–5 / 5
Water	—	5	5 / 5
Dischargeability	—		Not dischargeable
Metal in dyebath: Copper	3		5 (1) 4 (2 and 3)
Iron	4–5		5 (1, 2 and 3)
Solubility	Soluble in cold and hot water		—
NON-TEXTILE USAGE			Anodised aluminium See Leather Dyes section
REACTIONS	In substance: H_2SO_4 conc.—brownish yellow, on diln—clear yellow to orange		
NOTES	Its good solubility and slow rate of dyeing make it especially suitable for carbonised material		*Wool (3) similar

58	59	60	C.I. Mordant Brown
	Azo	Monoazo	CHEMICAL CLASS
		16065	C.I. CONSTITUTION NUMBER
Bluish Brown Redder	Reddish Brown Little change	Dull Reddish Brown Yellower	HUE: Daylight Artificial light (tungsten)
2		1, 2, 3 Afterchrome: Acetate—*u*, Cellulose—*u* Metachrome: Acetate—*u*, Cellulose—*ss*, Silk—*hs*	DYEING: WOOL Staining other fibres
	Silk: Chromium lactate Cotton: Pad with chromium acetate	Nylon: Afterchrome Silk: Afterchrome	DYEING: OTHER FIBRES
	Wool: Chromium lactate Silk: Chromium lactate Cotton: Chromium acetate	Wool: Cr mordant Vigoureux printing	PRINTING
ISO Wool (2)	ISO Cotton / Silk	ISO Wool (1) / Wool (2)	FASTNESS PROPERTIES ETC.
4	— / —	4–5 / 4	Method
—	— / —	–/1–2 / —	Substrate
4	— / —	4–5 / 4	Alkali
—	4–5* / —	— / —	Cross Dyeing Wool Acetic/Sulphuric
5	— / —	4–5 / 4	Carbonising
			Chlorination
			Decatising
—	— / —	4 / 4	Hot Pressing
—	4 / 5	5 / 5	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
6–7	4–5 / 5–6	6 / 6	normal
—	5 / 6	6–7 / 6–7	2× normal
—	— / 3–4	4 / 4	Milling: Alkaline
—	— / 4–5	— / —	Acid
—	— / —	— / 3–4	Peroxide Bleaching
4–5	— / —	4–5 / 5	Perspiration
4	— / —	2 / 4	Potting
4–5	— / —	4–5 / 5	Sea Water
4	— / —	4 / 4	Stoving
5	3–4 (40°C), 3 (100°C) / 5	5 / 4	Washing
5	— / —	5 / 5	Water
—	Dischargeable to white	—	Dischargeability
2	—	Redder	Metal in dyebath: Copper
4	—	Duller	Iron
—	—	—	Solubility
		Loose fur and hat bodies, borax clearing 4	NON-TEXTILE USAGE
			REACTIONS
	*Chlorine		NOTES

C.I. Mordant Brown	61	62	63	
CHEMICAL CLASS	Monoazo	Azo	Monoazo	
C.I. CONSTITUTION NUMBER	**16070**			
HUE: Daylight	Dull Reddish Brown	Reddish Brown	Reddish Brown	
Artificial light (tungsten)	Redder	Little change	Slightly redder	
DYEING: WOOL	1, 2		1, 2 3	
Staining other fibres	Afterchrome: Acetate—*u*, Cellulose—*u*		Afterchrome: Acetate—*hs*, Cellulose—*u*, Silk—*hs* Metachrome: Acetate—*ss*, Cellulose—*u*, Silk—*hs*	
DYEING: OTHER FIBRES	Silk: Afterchrome Nylon: Afterchrome	Cotton: Pad with chromium acetate		
PRINTING		Wool: Chromium lactate Silk: Chromium lactate Cotton: Chromium acetate		
FASTNESS PROPERTIES ETC.				
Method	AATCC	ISO	AATCC	ISO
Substrate	Wool (1)	Cotton	Wool (1)	Wool (1)*
Alkali	5	—	—	5
Cross Dyeing Wool Acetic/Sulphuric	—	—	—	1/1
Carbonising	5	—	4–5	4–5
Chlorination	—	4*	5	3–4
Decatising	—	—	5	5
Hot Pressing	5	—	4–5	4–5
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	—	4–5	5–6	6–7
normal	7	5–6	6	7
2× normal	—	6	6–7	7–8
Milling: Alkaline	4–5	—	5	5
Acid	—	—	—	—
Peroxide Bleaching	4	—	3–4	3–4
Perspiration	5	—	5	5
Potting	4	—	2–3	2–3
Sea Water	5	—	5	5
Stoving	5	—	5	5
Washing	5	3 (40°C), 2 (100°C)	5	5
Water	—	—	—	5
Dischargeability	2	Dischargeable to white	—	
Metal in dyebath: Copper	Redder	—	—	
Iron	Much yellower and duller	—	—	
Solubility	—	—	Suitable for package dyeing	
NON-TEXTILE USAGE	Leather: On chrome tannage			
REACTIONS			In substance: H_2SO_4 conc.—very dark red, on diln—dull orange	
NOTES		*Chlorine	*Wool (2) very similar	

64	65	66	C.I. Mordant Brown
Azo	Disazo	Monoazo	CHEMICAL CLASS
	28670	11890	C.I. CONSTITUTION NUMBER
Dull Brown	Reddish Brown		HUE: Daylight
Little change	Unchanged	Redder	Artificial light (tungsten)
	1	1, 2, 3	DYEING: WOOL
	Acetate—*hs* Cellulose—*hs*	Metachrome: Acetate—*ss–hs*, Cellulose—*ss–hs*, Silk—*hs*	Staining other fibres
Cotton: Pad with chromium acetate		Silk: Mordant Nylon: Afterchrome	DYEING: OTHER FIBRES
Wool: Chromium lactate Silk: Chromium lactate Cotton: Chromium acetate			PRINTING
ISO Cotton	ISO Wool (1)	ISO Wool (2)* Silk	FASTNESS PROPERTIES ETC. Method
—	5	4 —	Substrate
—	—	3/3 3/3	Alkali
—	5	4 —	Cross Dyeing Wool Acetic/Sulphuric
3–4	—	3 —	Carbonising
—	5	4 —	Chlorination
			Decatising
—	3–4	4 4	Hot Pressing
3–4	—	3 3	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
4	7	3–4 3–4	normal
4–5	—	4–5 4–5	2× normal
—	5	4 4	Milling: Alkaline
—	—	4–5 —	Acid
—	—	3–4 2	Peroxide Bleaching
—	5	4 4–5	Perspiration
—	—	3 —	Potting
—	5	4 —	Sea Water
4 (40°C), 3 (100°C)	5	4 3–4	Stoving
—	—	5 4–5	Washing
—	5	5 4–5	Water
Dischargeable to white		—	Dischargeability
—		1 (1), 2 (2 and 3)	Metal in dyebath: Copper
—		2 (1), 2–3 (2), 2 (3)	Iron
—		—	Solubility
			NON-TEXTILE USAGE
			REACTIONS
*Chlorine		*Wool (1) and (3) very similar except Potting: Wool (1) 2, Wool (3) 2–3	NOTES

C.I. Mordant Brown	67	68	69
CHEMICAL CLASS		Azo	Disazo
C.I. CONSTITUTION NUMBER			20120
HUE: Daylight	Yellowish Brown	Dull Yellowish Brown	Dull Reddish Brown
Artificial light (tungsten)	Little change	Little change	Redder
DYEING: WOOL			1, 3
Staining other fibres			Afterchrome: Acetate—*hs*, Cellulose—*hs*
DYEING: OTHER FIBRES	Silk: Chromium lactate Cotton: Pad with chromium acetate	Cotton: Pad with chromium acetate	Silk: Afterchrome
PRINTING	Wool: Chromium lactate Silk: Chromium lactate Cotton: Chromium acetate	Wool: Chromium lactate Silk: Chromium lactate Cotton: Chromium acetate	
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Cotton	Cotton	Wool (1)
Alkali	—	—	4
Cross Dyeing Wool Acetic/Sulphuric	—	—	–/2
Carbonising	—	—	5
Chlorination	4*	4–5*	—
Decatising	—	—	4
Hot Pressing	—	—	4–5
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	6	4	4–5
normal	6–7	4–5	5
2× normal	7	5	5–6
Milling: Alkaline	—	—	3–4
Acid	—	—	—
Peroxide Bleaching	—	—	—
Perspiration	—	—	5
Potting	—	—	4
Sea Water	—	—	4
Stoving	—	—	4–5
Washing	5 (40°C), 4 (100°C)	4–5 (40°C), 3–4 (100°C)	4–5
Water	—	—	5
Dischargeability	Dischargeable to white	Dischargeable to white	—
Metal in dyebath: Copper	—	—	3
Iron	—	—	3–4
Solubility	—	—	—
NON-TEXTILE USAGE			
REACTIONS			
NOTES	*Chlorine	*Chlorine	

70	71	C.I. Mordant Brown
Monoazo *	Monoazo	CHEMICAL CLASS C.I. CONSTITUTION NUMBER
Dull Reddish Brown Yellower and brighter	Dull Bordeaux Slightly redder	HUE: Daylight Artificial light (tungsten)
1 Acetate—*u* Cellulose—*u* Nylon—*d* Silk—*hs*	1, 3 Afterchrome: Acetate—*u*, Cellulose—*u*, Nylon—*hs*, Silk—*u*	DYEING: WOOL Staining other fibres
		DYEING: OTHER FIBRES
Wool: Cr mordant		PRINTING
AATCC Wool (1) 4–5 — 3 — — 5 3 4 5 4 — 1 4–5 4–5 4–5 4 4 — — Yellower Yellower —	AATCC Wool (1) 5 — 5 — 5 5 — 6 — 5 — 2 5 4 5 — 5 — 4 Redder Duller Very soluble in cold and hot water	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
See Leather Dyes section		NON-TEXTILE USAGE
In substance: H_2SO_4 conc.—bluish red, on diln—reddish orange. On wool: 10% H_2SO_4—brown, 10% NH_4OH—redder, $SnCl_2$ + HCl—destroyed	In substance: H_2SO_4 conc.—red, on diln—orange	REACTIONS
*Very similar to C.I. 13265		NOTES

C.I. Mordant Brown	72	73	74
CHEMICAL CLASS			Azo
C.I. CONSTITUTION NUMBER			
HUE: Daylight	Dull Yellowish Brown	Reddish Brown	Dull Yellowish Brown
Artificial light (tungsten)	Redder	Redder	Little change
DYEING: WOOL	1, 3	2	
Staining other fibres	Afterchrome: Acetate—*hs*, Cellulose—*ss*, Silk—*hs*		
DYEING: OTHER FIBRES			Silk: Chromium lactate Cotton: Pad with chromium acetate
PRINTING			Wool: Chromium lactate Silk: Chromium lactate Cotton: Chromium acetate
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Wool (1)	Wool (2)	Cotton / Silk
Alkali	5	4	— / —
Cross Dyeing Wool Acetic/Sulphuric	–/2	—	— / —
Carbonising	—	3–4	— / —
Chlorination	4–5	—	3–4* / —
Decatising	5	5	— / —
Hot Pressing	4–5	—	— / —
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	4	—	4 / 4
normal	4–5	6–7	5 / 4–5
2× normal	5	—	5–6 / 5
Milling: Alkaline	5	—	— / 4–5
Acid	—	—	— / —
Peroxide Bleaching	—	—	— / —
Perspiration	4–5	4–5	— / 4
Potting	4	4	— / —
Sea Water	4–5	5	— / —
Stoving	5	4	— / —
Washing	5	5	4 (40°C), 3 (100°C) / 5
Water	5	5	— / —
Dischargeability	—	—	Dischargeable to white
Metal in dyebath: Copper	3–4	3	—
Iron	3	3–4	—
Solubility	—	—	—
NON-TEXTILE USAGE			
REACTIONS			
NOTES			*Chlorine

75	76	77	C.I. Mordant Brown
Azo			CHEMICAL CLASS
			C.I. CONSTITUTION NUMBER
Dull Reddish Brown	Greyish Brown	Dull Brown	HUE: Daylight
Little change	Redder	Redder	Artificial light (tungsten)
	1	1, 2, 3	DYEING: WOOL
	Acetate—*hs* Cellulose—*hs*	Afterchrome: Acetate—*ss*, Cellulose—*ss*, Silk—*hs*	Staining other fibres
Cotton: Pad with chromium acetate			DYEING: OTHER FIBRES
Wool: Chromium lactate Silk: Chromium lactate Cotton: Chromium acetate			PRINTING
ISO Cotton	ISO Wool (1)	ISO Wool (1)	FASTNESS PROPERTIES ETC. Method
—	4	5	Substrate
—	–/3*	–/2	Alkali
—	4	4–5	Cross Dyeing Wool Acetic/Sulphuric
3–4*	3	—	Carbonising
—	4	4–5	Chlorination
			Decatising
—	4–5	5	Hot Pressing
3	4–5	5	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
3–4	5	6	normal
4	5–6	6–7	2× normal
—	4	4–5	Milling: Alkaline
—	—	—	Acid
—	2	—	Peroxide Bleaching
—	4–5	5	Perspiration
—	3–4	3	Potting
—	5	4–5	Sea Water
—	2–3	4–5	Stoving
5 (40°C), 4–5 (100°C)	4–5	5	Washing
—	5	5	Water
Dischargeable to white	—	—	Dischargeability
—	Slight change	2–3	Metal in dyebath: Copper
—	Slight change	2–3	Iron
—	—	—	Solubility
			NON-TEXTILE USAGE
			REACTIONS
*Chlorine	*Bisulphate		NOTES

C.I. Mordant Brown	78	79
CHEMICAL CLASS	Azo	
C.I. CONSTITUTION NUMBER		
HUE: Daylight	Dull Yellowish Brown	Bright Brown
Artificial light (tungsten)	Redder	Yellower
DYEING: WOOL	1, 2	1
Staining other fibres	Afterchrome: Acetate—*ss*, Cellulose—*ss*, Nylon—*d*, Silk—*d*	Acetate—*hs* Cellulose—*ss* Silk—*hs*
DYEING: OTHER FIBRES		Nylon: Afterchrome, high substantivity
PRINTING		
FASTNESS PROPERTIES ETC.		
Method	AATCC	ISO
Substrate	Wool (1)	Wool (1)
Alkali	4	4
Cross Dyeing Wool Acetic/Sulphuric	—	2/1
Carbonising	3	5
Chlorination	—	3
Decatising	4	4
Hot Pressing	3–4	4
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	—	3
normal	4	4
2× normal	—	4–5
Milling: Alkaline	4	3–4
Acid	—	—
Peroxide Bleaching	3	2
Perspiration	4–5	4–5
Potting	3–4	3
Sea Water	3	4–5
Stoving	—	2–3
Washing	4	4–5
Water	—	5
Dischargeability	—	—
Metal in dyebath: Copper	—	Marked change
Iron	—	Strong change
Solubility	Very slightly sol. in cold, very sol. in hot water	—
NON-TEXTILE USAGE		Leather
REACTIONS	In substance: H_2SO_4 conc.—scarlet, on diln—red	
NOTES		

80	81	82	C.I. Mordant Brown
Azo	Azo	Azo	CHEMICAL CLASS
			C.I. CONSTITUTION NUMBER
Yellowish Brown	Dull Brown	Dull Brown	HUE: Daylight
Little change	Little change	Little change	Artificial light (tungsten)
			DYEING: WOOL
			Staining other fibres
Silk: Chromium lactate Cotton: Pad with chromium acetate	Cotton: Pad with chromium acetate	Cotton: Pad with chromium acetate	DYEING: OTHER FIBRES
Wool: Chromium lactate Silk: Chromium lactate Cotton: Chromium acetate	Wool: Chromium lactate Silk: Chromium lactate Cotton: Chromium acetate	Wool: Chromium lactate Silk: Chromium lactate Cotton: Chromium acetate	PRINTING
ISO Cotton / Silk	ISO Cotton	ISO Cotton	FASTNESS PROPERTIES ETC.
— / —	—	—	Method
— / —	—	—	Substrate
— / —	—	—	Alkali
4* / —	4*	3–4*	Cross Dyeing Wool Acetic/Sulphuric
— / —	—	—	Carbonising
			Chlorination
— / —	—	—	Decatising
4 / 4–5	3–4	3–4	Hot Pressing
5 / 5	4	4	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
5–6 / 5	4–5	4–5	normal
— / 4–5	—	—	2× normal
— / —	—	—	Milling: Alkaline
— / —	—	—	Acid
— / —	—	—	Peroxide Bleaching
— / 4	—	—	Perspiration
— / —	—	—	Potting
— / —	—	—	Sea Water
— / —	—	—	Stoving
4 (40°C), 3 (100°C) / 5	4–5 (40°C), 4 (100°C)	4 (40°C), 3–4 (100°C)	Washing
— / —	—	—	Water
Dischargeable to white	Dischargeable to white	Dischargeable to white	Dischargeability
			Metal in dyebath: Copper
			Iron
			Solubility
			NON-TEXTILE USAGE
			REACTIONS
*Chlorine	*Chlorine	*Chlorine	NOTES

C.I. Mordant Brown	83	84	85
CHEMICAL CLASS		Anthraquinone	Azo
C.I. CONSTITUTION NUMBER			
HUE: Daylight	Dull Reddish Brown	Brown	Dull Reddish Brown
Artificial light (tungsten)	Redder	Slightly yellower	Little change
DYEING: WOOL	1	1, 2, 3	
Staining other fibres	Acetate—*u* Cellulose—*u* Nylon 6—*s* Silk—*s*	Afterchrome: Acetate—*hs*, Cellulose—*ss*	
DYEING: OTHER FIBRES		Silk: Afterchrome Nylon: Afterchrome	Cotton: Pad with chromium acetate
PRINTING	Wool: Cr mordant Vigoureux printing		Wool: Chromium lactate Silk: Chromium lactate Cotton: Chromium acetate
FASTNESS PROPERTIES ETC.			
Method	ISO	AATCC	ISO
Substrate	Wool (1)	Wool (1)	Cotton
Alkali	5	4	—
Cross Dyeing Wool Acetic/Sulphuric	–/4	—	—
Carbonising	5	4	—
Chlorination	—	—	4–5*
Decatising	5	3	—
Hot Pressing	4–5	5	—
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	5–6	—	4
normal	6	6	5
2× normal	7	—	6
Milling: Alkaline	5	4	—
Acid	—	—	—
Peroxide Bleaching	4	—	—
Perspiration	5	5	—
Potting	5	5	—
Sea Water	5	5	—
Stoving	4	3	—
Washing	5	5	3–4 (40°C), 2–3 (100°C)
Water	5	—	—
Dischargeability	Not dischargeable	—	Dischargeable to white
Metal in dyebath: Copper	Redder	Somewhat yellower	—
Iron	Duller	Somewhat yellower	—
Solubility	—	Slight sol. cold, sol. in hot water	—
NON-TEXTILE USAGE		Casein plastics from an acid bath Leather: On chrome and combination tannages	
REACTIONS		In substance: H_2SO_4 conc.—olive brown, on diln—reddish brown	
NOTES			*Chlorine

86	87	C.I. Mordant Brown
		CHEMICAL CLASS
		C.I. CONSTITUTION NUMBER
Reddish Brown	Yellowish Brown	HUE: Daylight Artificial light (tungsten)
		DYEING: WOOL Staining other fibres
		DYEING: OTHER FIBRES
		PRINTING
		FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
Anodised aluminium. Fastness—Light 5–6; Weather, good; Heat (*a*) 6 h at 200°C turns orange, (*b*) 1 h at 250°C turns more yellowish	Anodised aluminium: Fastness—Light 6; Weather, good; Heat (*a*) 6 h at 200°C weaker, (*b*) 1 h at 250°C weaker	NON-TEXTILE USAGE
		REACTIONS
		NOTES

C.I. Mordant Brown	88	89	90
CHEMICAL CLASS			Disazo
C.I. CONSTITUTION NUMBER			20151
HUE: Daylight	Brown		Brown
Artificial light (tungsten)			
DYEING: WOOL			Wool dyeing
Staining other fibres			
DYEING: OTHER FIBRES			
PRINTING			
FASTNESS PROPERTIES ETC.			
Method			
Substrate			
Alkali			
Cross Dyeing Wool Acetic/Sulphuric			
Carbonising			
Chlorination			
Decatising			
Hot Pressing			
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal			
normal			
2× normal			
Milling: Alkaline			
Acid			
Peroxide Bleaching			
Perspiration			
Potting			
Sea Water			
Stoving			
Washing			
Water			
Dischargeability			
Metal in dyebath: Copper			
Iron			
Solubility			
NON-TEXTILE USAGE	Anodised aluminium: Fastness—Light 5–6; Weather, fairly good; Heat (*a*) 6 h at 200°C weaker, (*b*) 1 h at 250°C much weaker	Anodised aluminium: Fastness—Light 6–7; Weather, fairly good; Heat (*a*) 6 h at 200°C much weaker, (*b*) 1 h at 250°C much weaker	
REACTIONS			
NOTES			

91	92	C.I. Mordant Brown
Monoazo	Monoazo	CHEMICAL CLASS
	14860	C.I. CONSTITUTION NUMBER
Dull Yellowish Brown Redder		HUE: Daylight Artificial light (tungsten)
1, 2, 3 Afterchrome: Acetate—*s*, Cellulose—*u* Metachrome: Acetate—*ss*, Cotton—*ss*, Nylon—*d*, Silk—*d*, Viscose—*u* Mordant: Acetate—*ss*, Cellulose—*u*, Nylon—*d*, Silk—*s*	1, 2	DYEING: WOOL Staining other fibres
Silk: Afterchrome, Mordant Nylon: Afterchrome		DYEING: OTHER FIBRES
Wool: Mordant Silk: Mordant		PRINTING
ISO Wool (2) Silk 4–5 — — — 4–5 — 4–5 — 3–4 — 3 3–4 5–6 5 6 5–6 6–7 5–6 4–5 — — — 3–4 4 5 5 3–4 — 4 — 4–5 — 5 4–5 5 — White discharge on silk dyed afterchrome Dull red (1), very much redder (2 and 3) Very much yellower (1 and 3), greener (2) Low		FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
		NON-TEXTILE USAGE
		REACTIONS
		NOTES

C.I. Mordant Brown	93	94
CHEMICAL CLASS		Disazo
C.I. CONSTITUTION NUMBER		
HUE: Daylight	Reddish Brown	Reddish Brown
Artificial light (tungsten)	Yellower	
DYEING: WOOL	1, 2, 3	
Staining other fibres	Afterchrome: Acetate—*s*, Cotton—*ss*, Nylon—*d* redder, Silk—*d* brighter, Viscose—*u* Metachrome: Acetate—*s*, Cotton—*ss*, Nylon—*d* brighter, Silk—*d* brighter, Viscose—*u*	
DYEING: OTHER FIBRES		Cellulose: Pad with chromium acetate or neutral chromate
PRINTING	Vigoureux printing with ammonium oxalate+chromium fluoride+sodium chlorate	Wool, Silk and Cellulose: Neutral chromate or chromium acetate
FASTNESS PROPERTIES ETC.		
Method	ISO	ISO
Substrate	Wool (1)*	Cellulose
Alkali	3	—
Cross Dyeing Wool Acetic/Sulphuric	4/3	—
Carbonising	4–5	—
Chlorination	4	—
Decatising	4–5	—
Hot Pressing	—	—
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	7	—
normal	7–8	4
2× normal	8	—
Milling: Alkaline	5	—
Acid	4	—
Peroxide Bleaching	4	—
Perspiration	5	—
Potting	4–5	—
Sea Water	5	—
Stoving	5	—
Washing	5	4 (40°C), 3 (100°C)
Water	—	—
Dischargeability	—	Neutral and alkaline very good
Metal in dyebath: Copper	Altered (1) Slightly altered (2)	—
Iron	Severely altered (1) Slightly altered (2)	—
Solubility	20 g/l at 80°C	—
NON-TEXTILE USAGE		
REACTIONS		
NOTES	*Wool (2) the same except Potting 4	

95	96	C.I. Mordant Brown
Monoazo	Monoazo	CHEMICAL CLASS
		C.I. CONSTITUTION NUMBER
Greenish Brown (sealed with nickel acetate) Red (sealed with water)	Brown Redder	HUE: Daylight Artificial light (tungsten)
	1 Acetate—*ss* Acrylic—*vss* Cellulose—*ss* Polyester—*vss*	DYEING: WOOL Staining other fibres
	Nylon: Afterchrome dyed bluer and duller than wool	DYEING: OTHER FIBRES
		PRINTING
	ISO Wool (1) 4 4–5/4 5 — 4–5 5 5–6 6 6–7 4–5 4–5 3–4 5 4 5 4 5 5 3–4 3–4 1–2 60 g/l	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
Anodised aluminium: Fastness to light 6–7		NON-TEXTILE USAGE
		REACTIONS
		NOTES

C.I. Mordant Black 1—3

C.I. Mordant Black	1	1:1	2	3
CHEMICAL CLASS	Monoazo		—	Monoazo
C.I. CONSTITUTION NUMBER	**15710**		—	**14640**
HUE: Daylight	Bluish Grey→Black		Bluish Grey	Bluish Grey→Bluish Black
Artificial light (tungsten)	Slightly yellower		Somewhat bluer	Slightly redder
DYEING: WOOL	1 (needs little chrome), 3			1, 3
Staining other fibres	Afterchrome: Acetate—*ss–hs*, Cotton—*u–ss*, Viscose—*u–hs* Mordant: Acetate—*ss–hs*, Cotton—*u–ss*, Viscose—*u*			Afterchrome: Acetate—*u–s*, Cellulose—*u–s* Mordant: Acetate—*ss*, Cotton—*u*
DYEING: OTHER FIBRES	Silk: Afterchrome, Mordant Nylon: Afterchrome		Cotton: Cr mordant	Silk: Afterchrome Nylon: Afterchome, high substantivity
PRINTING	Wool: Cr mordant Vigoureux printing			Wool: Chromium acetate Vigoureux printing
FASTNESS PROPERTIES ETC.				
Method	AATCC	ISO	ISO	AATCC ISO
Substrate	Wool (1)	Wool (1) Wool (2)	Cotton	Wool (1) Wool (1) Wool (3)
Alkali	5	4–5 5	—	5 4–5 4–5
Cross Dyeing Wool Acetic/Sulphuric	4/3	4–5/4–5 5/5	—	4/4 5/5 5/4–5
Carbonising	4	5 5	—	5 4–5 4–5
Chlorination	—	4–5 5	3*	— 4–5 3
Decatising	5	5 5	—	5 5 5
Hot Pressing	4–5	4–5 4	—	4 4–5 4–5
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	6–7	7–8 7–8	3	4 5–6 6
normal	—	— —	4	6 6 6–7
2× normal	—	7–8 7–8	4–5	8 7 7
Milling: Alkaline	4–5	5 4	—	4–5 4–5 4
Acid	—	4–5 5	—	— 4 4
Peroxide Bleaching	5	4–5 4–5	—	5 4 3
Perspiration	5	5 4–5	—	5 5 4–5
Potting	4	4–5 4	—	4–5 4–5 4
Sea Water	4	5 4–5	—	4–5 5 4–5
Stoving	5	4–5 5	—	4–5 4–5 5
Washing	5	5 5	4–5	5 5 4–5
Water	5	5 5	—	5 5 4–5
Dischargeability	Unsuitable			Unsuitable
Metal in dyebath: Copper	—			2
Iron	—			1
Solubility	—			—
NON-TEXTILE USAGE	See Leather Dyes section			See Leather Dyes section
REACTIONS	On wool: HNO_3 conc.—blackish violet, faint white rim			
NOTES	Particularly used on fine wools as does not affect spinning properties and on a chrome mordant in conjunction with Logwood (C.I. Natural Black 1) Fastness on Silk (AATCC): Afterchrome and Metachrome—Light 6–7, Peroxide 1, Perspiration 4, Washing 4–5 (Afterchrome), 4 (Mordant)		*Chlorine	

Slightly different chemically from C.I. Mordant Black 1, but very similar in properties and usage

C.I. Mordant Black	4	5		6
CHEMICAL CLASS		Disazo		
C.I. CONSTITUTION NUMBER		26695		
HUE: Daylight	Reddish Navy→Bluish Black			Greenish grey
Artificial light (tungsten)	Redder			Unchanged
DYEING: WOOL	1	1 (needs little chrome), 2, 3		1
Staining other fibres	Acetate—*hs* Cellulose—*u* Silk—*hs*	Afterchrome: Acetate—*u–hs*, Cellulose—*ss–hs* Metachrome and Mordant: Acetate—*hs*, Cellulose—*hs*, Silk—*d*		Cotton—*u*
DYEING: OTHER FIBRES		Silk: Afterchrome Nylon: Afterchrome, good substantivity		
PRINTING				
FASTNESS PROPERTIES ETC.				
Method	ISO	AATCC	ISO	ISO
Substrate	Wool (1)	Wool (1)	Wool (1)*	Wool(1)
Alkali	5	5	5	4–5
Cross Dyeing Wool Acetic/Sulphuric	4–5/4–5	3–4/3–4	5/4–5	4–5/4
Carbonising	4–5	5	5	4–5
Chlorination	3–4	—	4–5	4
Decatising	4	4–5	4–5	4–5
Hot Pressing	4	3 dry 4 wet	4	—
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	—	4–5	4–5	—
normal	6–7	6–7	6	6
2× normal	—	7	6–7	—
Milling: Alkaline	4–5	4	5	4–5
Acid	—	—	5	—
Peroxide Bleaching	3–4	2	3–4	4
Perspiration	4	5	5	4
Potting	3–4	3–4	4	4–5
Sea Water	4	5	5	5
Stoving	4–5	4–5	4–5	4–5
Washing	5	4–5	5	5
Water	5	5	5	5
Dischargeability	—	Poor		—
Metal in dyebath: Copper	1	4–5		1
Iron	1	4		1
Solubility	—	Very soluble in hot water		—
NON-TEXTILE USAGE		Biological stain (when purified) Hat dyeing, very good fastness to borax clearing See Leather Dyes section		
REACTIONS		On wool: see Walker, *JSDC*, **28** (1912) 15		
NOTES		*Wool (2) and (3) similar		

7	8	9	
Monoazo	Monoazo	Monoazo	CHEMICAL CLASS
16505		16500	C.I. CONSTITUTION NUMBER
Bluish Black Unchanged	Bluish Black Duller and greener	Black Slightly redder	HUE: Daylight Artificial light (tungsten)
1, 3 Afterchrome: Acetate—*ss–hs*, Cotton—*ss–hs*, Viscose—*u–hs* Mordant: Acetate—*hs*, Cellulose—*hs*, Silk—*hs*	1 Acetate—*ss* Cotton—*ss* Silk—*s* Viscose—*u*	1 (needs little chrome), 3 Afterchrome: Acetate—*ss–hs*, Cotton—*vss–hs*, Viscose—*ss–hs* Mordant: Acetate—*s*, Cellulose—*ss*, Silk—*hs*	DYEING: WOOL Staining other fibres
Silk: Afterchrome Nylon: Afterchrome			DYEING: OTHER FIBRES
Wool: Cr mordant Vigoureux printing		Wool: Cr mordant	PRINTING

AATCC	ISO		ISO	AATCC	ISO		FASTNESS PROPERTIES ETC.
Wool (1)	Wool (1)	Wool (3)	Wool (1)	Wool (1)	Wool (1)	Wool (3)	
5	5	5	5	5	4–5	4	Method
—	5/5	—	—	4/3	5/5	5/5	Substrate
5	5	4	5	5	5	4–5	Alkali
—	5	—	—	—	4–5	5	Cross Dyeing Wool Acetic/Sulphuric
5	5	5	5	5	5	5	Carbonising
							Chlorination
5	4–5	5	5	5	4	—	Decatising
—	—	—	—	4	4	—	Hot Pressing
7	7–8	—	7	7	8	7–8	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
—	7–8	7	—	8	8	8	normal
5	5	3–4	5	5	5	3–4	2× normal
—	4–5	—	4–5	—	4	—	Milling: Alkaline
2–3	3–4	—	4	2–3	3–4	3–4	Acid
5	5	4	5	5	5	4–5	Peroxide Bleaching
5	5	2	5	5	4	2–3	Perspiration
							Potting
5	5	4	5	5	5	4	Sea Water
5	5	5	5	5	5	5	Stoving
5	5	5	5	5	5	3–4	Washing
5	5	—	5	5	5	4–5	Water
Unsuitable			—	Poor			Dischargeability
3–4 (1), 3 (3)			4–5	4 redder			Metal in dyebath: Copper
3–4 (1), 2 (3)			2–3	3 browns			Iron
—			Excellent	Suitable for package dyeing			Solubility

Hat dyeing, very good fastness to borax clearing See Leather Dyes section		Anodised aluminium Hat dyeing, very good fastness to borax clearing See Leather Dyes section	NON-TEXTILE USAGE
On wool: HNO_3 conc.—reddens slightly, greenish rim			REACTIONS
			NOTES

C.I. Mordant Black	10	11	12
CHEMICAL CLASS	Disazo	Monoazo	Azo
C.I. CONSTITUTION NUMBER	21720	14645	
HUE: Daylight	Dull Bluish Black	Bluish Grey→Bluish Black	Black
Artificial light (tungsten)	Greener	Unchanged	Little change
DYEING: WOOL	1	1 (needs little chrome), 2, 3	—
Staining other fibres	Acetate—*hs* Cellulose—*hs* Nylon—*d* Silk—*d*	Afterchrome: Acetate—*ss–hs*, Cotton—*ss–hs*, Viscose—*u–hs* Mordant: Acetate—*ss–hs*, Cotton—*ss–hs*, Silk—*d*, Viscose—*hs*	—
DYEING: OTHER FIBRES		Silk: Afterchrone, Mordant Nylon: Afterchrome, high substantivity, 90–120 min boil needed for lake completion	Silk: Chromium lactate
PRINTING		Wool: Cr mordant Vigoureux printing	Wool: Chromium lactate Silk: Chromium lactate

FASTNESS PROPERTIES ETC.

Method	AATCC	AATCC	ISO		ISO
Substrate	Wool (1)	Wool (1)	Wool (1)	Wool (3)	Silk (1)	Silk (dyed)
Alkali	4	4	4–5	4	—	—
Cross Dyeing Wool Acetic/Sulphuric	—	4/4	5/5	5/5	4/5	—
Carbonising	5	5	5	5	—	—
Chlorination	—	—	4–5	5	—	—
Decatising	4	5	5	5	—	—
Hot Pressing	4	4–5	4–5	4–5	4–5	—
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	—	5	—	—	5	—
normal	—	7	7	7	6	5
2× normal	7–8	8	8	8	7	—
Milling: Alkaline	4–5	4–5	5	4–5	3	4
Acid	—	—	5	5	—	—
Peroxide Bleaching	2–3	5	4–5	4–5	4	—
Perspiration	—	5	5	4–5	3	3
Potting	4	4–5	4–5	5	—	—
Sea Water	4	5	5	5	—	—
Stoving	4	5	5	5	4	—
Washing	4–5	5	5	5	4–5	5
Water	4	5	5	5	5	—
Dischargeability	—		—			Dischargeable to white
Metal in dyebath: Copper	No effect		—			—
Iron	Brown		—			—
Solubility	—		—			—

NON-TEXTILE USAGE	Leather: On chrome tannage	Biological Stain Loose fur and hat bodies, very good fastness to borax clearing	
REACTIONS			
NOTES			

13	14	15	C.I. Mordant Black
Anthraquinone 63615	Oxazine	Monoazo 15690	CHEMICAL CLASS C.I. CONSTITUTION NUMBER
Bluish Grey→Black Duller	Reddish Grey Little change	Reddish Navy→Bluish Black Slightly redder	**HUE:** Daylight Artificial light (tungsten)
1, 2, 3 Afterchrome: Acetate—*ss–hs*, Cellulose—*u–hs*, Silk—*ss–d* Metachrome: Acetate—*ss–hs*, Cotton—*ss*, Silk—*ss–d*, Viscose—*ss–hs* Mordant: Acetate—*ss*, Cellulose—*ss*, Silk—*s–hs*	— —	1, 2, 3 Afterchrome: Acetate—*hs*, Cellulose—*u–ss* Metachrome: Acetate—*hs*, Cotton—*u–ss* Mordant: Acetate—*hs*, Cotton—*u–ss*, Silk—*hs*, Viscose—*u*	**DYEING: WOOL** Staining other fibres
Nylon: Afterchrome (medium substantivity)* Silk: Metachrome yields weaker and redder dyeings than on weighted silk	Silk: Chromium lactate	Silk: Afterchrome Nylon: Afterchrome	**DYEING: OTHER FIBRES**
Wool: Cr mordant Silk: Cr mordant Cotton: Cr mordant Vigoureux printing	Wool: Chromium lactate Silk: Chromium lactate	Wool: Cr mordant Vigoureux printing	**PRINTING**
AATCC Wool (1) / ISO Wool (1)†	ISO Silk (dyed)	AATCC Wool (1) / ISO Wool (1)*	**FASTNESS PROPERTIES ETC.**
5 / 5	—	4–5 / 4–5	Method
4/3 / 4–5/4–5	—	— / 4–5/4–5	Substrate
4–5 / 5	—	5 / 4–5	Alkali
— / 5	—	— / 4	Cross Dyeing Wool Acetic/Sulphuric
5 / 5	—	4–5 / 4–5	Carbonising
			Chlorination
			Decatising
5 / 4	—	5 / 5	Hot Pressing
4 / 4	—	— / 6	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
5 / 5	3–4	— / 6	normal
6 / 6	4	7 / 7	2× normal
4–5 / 4–5	—	4–5 / 3–4	Milling: Alkaline
— / 4–5	—	— / 5	Acid
3–4 / 2	—	3 / 3	Peroxide Bleaching
5 / 5	4–5	4–5 / 4–5	Perspiration
5 / 5	—	2 / 2	Potting
5 / 5	—	4–5 / 4–5	Sea Water
5 / 5	—	4–5 / 4–5	Stoving
4–5 / 5	4–5	4–5 / 4	Washing
5 / 5	—	4–5 / 4–5	Water
Unsuitable		—	Dischargeability
2		Much more violet	Metal in dyebath: Copper
2 (1), 3 (1), 4 (1)		Brown (1), 4 (2), 3–4 (3)	Iron
—		—	Solubility
Biological Stain See Leather Dyes section		See Leather Dyes section Paper: as a coating colour	**NON-TEXTILE USAGE**
			REACTIONS
*90–120 min boil needed for lake completion †Wool (2) and (3) similar		Wool* (2) and (3) similar	**NOTES**

C.I. Mordant Black	16	17	
CHEMICAL CLASS	Monoazo	Monoazo	
C.I. CONSTITUTION NUMBER		15705	
HUE: Daylight	Greenish Black	Dull Reddish Navy→Bluish Black	
Artificial light (tungsten)	Duller	Duller and redder	
DYEING: WOOL	1, 2, 3	1, 3	
Staining other fibres	Afterchrome: Acetate—*u*, Cellulose—*u*, Silk effects remain white only if dyeing and chroming are carried out with acetic acid, a fresh bath being used for chroming	Afterchrome: Acetate—*u–hs*, Cellulose—*u* Mordant: Acetate—*hs*, Cellulose—*hs*, Silk—*hs*	
DYEING: OTHER FIBRES		Silk: Afterchrome Nylon: Afterchrome	
PRINTING	Nylon: Afterchrome	Wool: Cr mordant Suitable as an illuminating colour in discharges Vigoureux printing	
FASTNESS PROPERTIES ETC.			
Method	AATCC	AATCC	ISO
Substrate	Wool (1)	Wool (1)	Wool (1)*
Alkali	5	4–5	4–5
Cross Dyeing Wool Acetic/Sulphuric	—	3/3	–/5
Carbonising	5	—	—
Chlorination	—	—	4–5
Decatising	—	—	5
Hot Pressing	dry 3, wet 5	4–5	4–5
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	—	5	7
normal	8	6	7–8
2× normal	—	7	8
Milling: Alkaline	3	4–5	5
Acid	—	—	3–4
Peroxide Bleaching	4	5	3–4
Perspiration	5	4–5	5
Potting	4	4–5	4
Sea Water	5	5	4
Stoving	5	5	4–5
Washing	4	5	5
Water	—	5	5
Dischargeability	—	Not dischargeable	
Metal in dyebath: Copper	Bluer and duller	Much redder	
Iron	Much duller	Destroyed	
Solubility	Soluble in cold, very soluble in hot water	Good	
NON-TEXTILE USAGE	Leather: on chrome tannage	Loose wool, fur and hat bodies, very good fastness to borax clearing Pigment. Biological stain See Leather Dyes section	
REACTIONS	In substance: H_2SO_4 conc.—bright red, on diln—pale red	On wool: HNO_3 conc.—dirty yellow turning redder, pale rim	
NOTES		*Wool (3) much the same but less fast to alkaline milling	

18	19	C.I. Mordant Black
Disazo	Monoazo	CHEMICAL CLASS
26955	12200	C.I. CONSTITUTION NUMBER
Black Little change	Bluish Grey Slightly redder and weaker	HUE: Daylight Artificial light (tungsten)
1. To obtain normal milling fastness dye weakly acid and avoid excess acid in exhausting Acetate—*ss* Cellulose—*ss* Silk—*s*	1, 2, 3 Metachrome: Acetate—*s*, Cellulose—*ss*, Silk—*hs*	DYEING: WOOL Staining other fibres
		DYEING: OTHER FIBRES
		PRINTING
ISO Wool (1) 5 — 3–4 — 4–5 5 — 6 — 5 4–5 4 5 4 5 4–5 5 5 — 3 2 —	ISO Wool (2)* 4 4/3 4 4 4 4 4–5 5 6 4–5 4–5 4 4 3 4 4 5 5 Good dithionite discharge 2–3 3 Insol. in cold, sol. in hot water	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
		NON-TEXTILE USAGE
		REACTIONS
	*Wool (1) and (3) similar, but rather less fast to wet processing	NOTES

C.I. Mordant Black	20		21
CHEMICAL CLASS	Azo		
C.I. CONSTITUTION NUMBER			
HUE: Daylight	Bluish Grey→Black		Bluish Grey
Artificial light (tungsten)	Duller and greener		Slightly duller
DYEING: WOOL	1		1
Staining other fibres	Acetate—*s* Cotton—*vss* Silk—*ss*		Acetate—*hs* Cellulose—*hs* Silk—*d*
DYEING: OTHER FIBRES			
PRINTING			
FASTNESS PROPERTIES ETC.			
Method	AATCC	ISO	ISO
Substrate	Wool (1)	Wool (1)	Wool (1)
Alkali	—	4	5
Cross Dyeing Wool Acetic/Sulphuric	—	–/4	—
Carbonising	5	5	5
Chlorination	4–5	—	—
Decatising	4–5	4	4
Hot Pressing	5	5	5
Light: ⅛–½ normal	—	—	5
normal	5–6	6	6
2× normal	—	7	7
Milling: Alkaline	4	4	4–5
Acid	—	4–5	—
Peroxide Bleaching	5	—	—
Perspiration	4–5	5	5
Potting	5	3–4	4–5
Sea Water	—	5	5
Stoving	—	4	5
Washing	—	4	5
Water	—	5	—
Dischargeability		2	—
Metal in dyebath: Copper		5	3
Iron		4	1
Solubility		—	Poor in cold, good in hot water
NON-TEXTILE USAGE			
REACTIONS			In substance: H_2SO_4 conc.–dull blue to violet, on diln—turbid violet brown
NOTES			

22	23	24	C.I. Mordant Black
		Azo	CHEMICAL CLASS
			C.I. CONSTITUTION NUMBER
Bluish Grey Slightly duller	Black Slightly duller	Greenish Grey Somewhat greener	HUE: Daylight Artificial light (tungsten)
1 Acetate—*hs* Cellulose—*ss* Silk—*d*	1 Acetate—*ss* Cellulose—*ss* Silk—*s*	1 Acetate—*vss* Cotton—*u* Silk—*ss*	DYEING: WOOL Staining other fibres
			DYEING: OTHER FIBRES
	Wool: Cr mordant Vigoureux printing		PRINTING
ISO Wool (1) 5 — 5 — 4 5 5–6 6–7 7 4–5 — — 4–5 4 5 5 5 — — 2–3 1 Poor in cold, clear soln in hot water	ISO Wool (1) 5 –/2 5 — 5 5 — 6 — 4 4–5 3–4 4–5 4 5 4 4–5 5 — 2 1–2 —	AATCC Wool (1) — — 4–5 4–5 4–5 4–5 — 4 — 4 — — 4 4 5 — — — 3–4 2 1 —	ISO Wool (1) 5 –/4–5 5 – 5 5 4–5 5 6 4 3 — 5 4 — 4 4 —	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
			NON-TEXTILE USAGE
In substance: H_2SO_4 conc.—dull bluish violet, on diln—turbid violet brown			REACTIONS
			NOTES

C.I. Mordant Black	25	26		27
CHEMICAL CLASS	Disazo	Azo		Azo
C.I. CONSTITUTION NUMBER	21725			
HUE: Daylight	Bluish Black	Greenish Black		Black
Artificial light (tungsten)	Little change	Slightly yellower		Little change
DYEING: WOOL	1, 3	1, 2		
Staining other fibres	Afterchrome: Acetate—*u–ss*, Cellulose—*ss*, Silk—*d* Mordant: Acetate—*ss*, Cellulose—*ss*, Silk—*d*	Afterchrome: Acetate—*u*, Cellulose—*u*, Nylon—*u*, Silk—*ss*		
DYEING: OTHER FIBRES				Cotton: Pad with Cr mordant
PRINTING	Vigoureux printing			Cotton: Ammonium chromate
FASTNESS PROPERTIES ETC.				
Method	ISO	AATCC	ISO	ISO
Substrate	Wool (1)	Wool (1)	Wool (1)	Dyed cotton
Alkali	4–5	—	5	—
Cross Dyeing Wool Acetic/Sulphuric	—	—	–/2	—
Carbonising	5	5	5	—
Chlorination	—	4–5	3	4*
Decatising	4–5	5	5	—
Hot Pressing	5	5	5	—
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	—	—	—	—
normal	7	—	7	4
2× normal	7	7–8	7–8	—
Milling: Alkaline	5	4	4–5	—
Acid	4–5	—	3–4	—
Peroxide Bleaching	4	—	4–5	—
Perspiration	4	4–5	5	—
Potting	3	4	3	—
Sea Water	4–5	4–5	5	—
Stoving	4–5	—	4–5	—
Washing	5	5	5	3–4 (40°C), 2 (100°C)
Water	5	—	5	—
Dischargeability	—	—		Dischargeable to white
Metal in dyebath: Copper	3	Marked change		—
Iron	Turns brown	Strong change		—
Solubility	—	—		—
NON-TEXTILE USAGE	Hat dyeing, very good fastness to borax clearing	Leather: On chrome and vegetable tannages		
REACTIONS		In substance: H_2SO_4 conc. —maroon, on diln—yellower		
NOTES				*Chlorine

28	29	C.I. Mordant Black
Azo	Monoazo	CHEMICAL CLASS
	14865	C.I. CONSTITUTION NUMBER
Black	Bluish Grey→Bluish Black	HUE: Daylight
Little change	Slightly redder	Artificial light (tungsten)
	1, 2, 3 Afterchrome: Acetate and Cotton—*u–ss*, Viscose—*u* Metachrome: Acetate and Cellulose—*u–ss*, Silk—*s–hs* Mordant: Acetate and Cotton—*vss*, Silk—*ss*, Viscose—*u*	DYEING: WOOL Staining other fibres
Cotton: Pad with chromium acetate	Silk: Mordant Nylon: Afterchrome	DYEING: OTHER FIBRES
Wool: Chromium lactate Silk: Chromium lactate Cotton: Chromium acetate	Wool: Cr mordant Vigoureux printing	PRINTING

ISO Cotton	AATCC Wool (1)	AATCC Silk	ISO Wool (1)*	FASTNESS PROPERTIES ETC.
—	—	—	5	Method
—	—	3/2	4/3–4	Substrate
—	5	—	4	Alkali
4*	—	—	3	Cross Dyeing Wool Acetic/Sulphuric
—	4	—	4	Carbonising
				Chlorination
—	4	4A, 5B	4	Decatising
—	—	5	5	
5–6	5	6	6	Hot Pressing
—	—	6–7	6–7	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
—	5	4	4	normal
—	—	—	3	2× normal
—	—	1	3	Milling: Alkaline
—	5	—	5	Acid
—	5	1	4	Peroxide Bleaching
				Perspiration
—	5	—	5	Potting
—	—	3–4	4–5	
4–5 (40°C), 3–4 (100°C)	5	4–5	4–5	Sea Water
—	5	5	4–5	Stoving
				Washing
				Water
Dischargeable to white	Dyed metachrome discharges†			
—	Marked change (1), more violet (2), redder (3)			Dischargeability
—	Marked change (1), trace duller (2), destroyed (3)			Metal in dyebath: Copper
—	—			Iron
				Solubility
				NON-TEXTILE USAGE
				REACTIONS
*Chlorine	*Wool (2) and (3) very similar †With sodium sulphoxylate formaldehyde			NOTES

C.I. Mordant Black	30	31	32
CHEMICAL CLASS			Azo
C.I. CONSTITUTION NUMBER			
HUE: Daylight	Black	Greenish Grey	Bluish Grey
Artificial light (tungsten)	Slightly duller	Little change	Somewhat redder
DYEING: WOOL	1, 3	1, 2	1, 2, 3
Staining other fibres	Afterchrome: Acetate—*u*, Cellulose—*ss*, Silk—*d* Mordant: Acetate—*u*, Cellulose—*ss*, Silk—*hs*	Afterchrome: Acetate—*vss*, Cotton—*u*, Silk—*hs*	Acetate—*vss* Cotton—*vss* Silk—*ss*
DYEING: OTHER FIBRES			
PRINTING		Wool: Cr mordant Vigoureux with chromate or chromium fluoride	

FASTNESS PROPERTIES ETC.								
Method	ISO		AATCC	ISO		AATCC	ISO	
Substrate	Wool (1)	Wool (3)	Wool (1)	Wool (1)	Wool (2)	Wool (1)	Wool (1)	Wool (2)*
Alkali	5	5	—	5	—	—	5	4
Cross Dyeing Wool Acetic/Sulphuric	—	—	–/3	–/4	—	—	3–4/3–4	4/4
Carbonising	4	4	—	3	3	4	4–5	4
Chlorination	—	—	4	—	4	4–5	5	4
Decatising	5	5	5	4–5	4–5	5	5	5
Hot Pressing	5	5	5	5	5	4–5	5	5
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	—	—	—	5–6	5–6	—	6	6
normal	—	—	4–5	6–7	6–7	4	6–7	6–7
2× normal	5	5	—	7	7	—	7	7
Milling: Alkaline	5	3–4	—	4	4–5	4	5	5
Acid	—	—	—	1–2	—	—	4–5	5
Peroxide Bleaching	—	—	—	—	—	—	2	3–4
Perspiration	4–5	4	4	5	5	5	5	5
Potting	3	2	3–4	4–5	4	4–5	4	4–5
Sea Water	5	5	5	—	—	5	5	5
Stoving	4–5	5	—	5	—	—	4–5	4
Washing	5	4–5	—	4–5	4–5	—	4–5	5
Water	—	—	—	—	—	—	4–5	5
Dischargeability	—			2			—	
Metal in dyebath: Copper	5			2 (1), 4 (2)			3	
Iron	5			1 (1), 3–4 (2)			1	
Solubility	Clear soln in cold and hot water			—			—	

NON-TEXTILE USAGE			
REACTIONS	In substance: H_2SO_4 conc.—bluish green, on diln—reddish violet		
NOTES			*Wool (3) similar but fastness to carbonising, acid milling and potting lower

33	34	35	C.I. Mordant Black
Monoazo	Oxazine		CHEMICAL CLASS
			C.I. CONSTITUTION NUMBER
Reddish Grey Little change	Grey Little change	Greenish Grey Somewhat greener	HUE: Daylight Artificial light (tungsten)
1 Acetate—*s* Cotton—*vss* Nylon—*s* Silk—*ss* Viscose—*s*		1, 2, 3 Afterchrome: Acetate—*s*, Cotton—*ss*, Silk—*hs*	DYEING: WOOL Staining other fibres
Nylon: Afterchrome		Silk: Afterchrome, Mordant	DYEING: OTHER FIBRES
	Wool: Cr mordant Silk: Cr mordant Cotton: Cr mordant Suitable for illuminating discharges		PRINTING

AATCC Wool (1)	ISO Wool (1)	ISO Cotton	ISO Wool (1)	FASTNESS PROPERTIES ETC.
4–5	5	—	4–5	Method
—	–/3	—	–/4	Substrate
4	5	—	5	Alkali
4	—	2–3*	—	Cross Dyeing Wool Acetic/Sulphuric
5	5	—	—	Carbonising
				Chlorination
				Decatising
5	5	—	5	Hot Pressing
—	5	4	4	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
5	5–6	5	4–5	normal
—	6–7	6	5	2× normal
5	4	—	4–5	Milling: Alkaline
—	3	—	—	Acid
2	—	—	—	Peroxide Bleaching
5	5	—	4–5	Perspiration
4–5	4	—	3	Potting
5	—	—	—	Sea Water
4	3–4	—	5	Stoving
5	4	4–5	5	Washing
—	—	—	—	Water
2–3			2	Dischargeability
Redder			4 (metachrome 5)	Metal in dyebath: Copper
Very brownish			2–3	Iron
Sol. cold, very sol. hot water			—	Solubility

			NON-TEXTILE USAGE
In substance: H_2SO_4 conc.—bluish violet, on diln—red			REACTIONS
	*Chlorine		NOTES

C.I. Mordant Black	36	37	38
CHEMICAL CLASS		Naphthoquinone	Monoazo
C.I. CONSTITUTION NUMBER		57010	18160
HUE: Daylight		Grey→Reddish Black	Bluish Grey
Artificial light (tungsten)		Unchanged	Redder and brighter
DYEING: WOOL		1, 3	1, 2, 3
Staining other fibres	This C.I. Generic Name is discontinued, dyes formerly listed under it now appear under C.I. Mordant Black 32	Mordant: Acetate—*hs*, Cellulose—*hs*	Afterchrome: Acetate—*u–hs*, Cotton—*u–ss*, Viscose—*u* Metachrome: Acetate—*u–ss*, Cotton—*u–ss*, Silk—*ss–hs*, Viscose—*u–hs*
DYEING: OTHER FIBRES		Cotton: Cr mordant	Silk: Afterchrome, Metachrome Nylon: Afterchrome, high substantivity
PRINTING		Wool: Cr mordant Silk: Cr mordant Cotton: Cr mordant As an illuminating colour in discharges	Wool: Cr mordant Vigoureux printing
FASTNESS PROPERTIES ETC.			
Method		ISO	AATCC / ISO
Substrate		Wool (1) / Wool (2)	Wool (1) / Wool (1)*
Alkali		5 / 5	5 / 5
Cross Dyeing Wool Acetic/Sulphuric		–/3–4 / —	4/2–3 / 4/4
Carbonising		4–5 / 4	3 / 3–4
Chlorination		— / —	— / 4
Decatising		5 / 5	3 / 4
Hot Pressing		5 / 5	4 / 4
Light: ⅛–½ normal		6 / 7	5 / 5–6
normal		— / —	6 / 6
2× normal		— / —	7 / 6–7
Milling: Alkaline		5 / 4	4–5 / 4
Acid		4 / —	— / 1
Peroxide Bleaching		4 / —	2–3 / 2
Perspiration		5 / 5	5 / 4–5
Potting		4 / 5	4 / 3–4
Sea Water		4 / 5	5 / 5
Stoving		5 / 5	5 / 4
Washing		5 / —	4–5 / 4–5
Water		5 / 5	5 / 5
Dischargeability		—	Unsuitable
Metal in dyebath: Copper		2	1
Iron		1	1
Solubility		—	—
NON-TEXTILE USAGE			See Leather Dyes section
REACTIONS			
NOTES		Printed cotton—fastness: Chlorine 2–3; Light 4, 5, 6; Washing 4–5	*Wool (2) very similar

39	40	41	C.I. Mordant Black
Azo		Monoazo	CHEMICAL CLASS
			C.I. CONSTITUTION NUMBER
Black Somewhat redder	Bluish Grey Somewhat greener	Bluish grey Little change	HUE: Daylight Artificial light (tungsten)
1 Acetate—*hs* Cellulose—*hs*	1, 3 Afterchrome: Acetate—*ss*, Cellulose—*u*, Silk—*hs*	1, 2, 3 Afterchrome: Acetate—*ss*, Cellulose—*u* Metachrome: Acetate—*ss*, Cellulose—*u*	DYEING: WOOL Staining other fibres
Silk: Afterchrome Nylon: Afterchrome		Silk: Afterchrome, Metachrome Nylon: Afterchrome, 90–120 min boil for lake completion	DYEING: OTHER FIBRES
Wool: Chromium acetate	Vigoureux printing	Wool: Cr mordant	PRINTING
ISO Wool (1) 5 3/4–5 5 4–5 4 5 — 6 6–7 5 3–4 3–4 5 4–5 5 5 5 5 Unsuitable — — Suitable for package dyeing	ISO Wool (1) 5 5/4 4 5 4–5 5 5 5–6 6–7 4 4–5 2 5 5 4–5 4–5 4–5 5 Fairly good with dithionite 2 1 Good	ISO Wool (1)* 5 4/4 5 5 4–5 4 6 6–7 7 4–5 3–4 2–3 5 4 5 4–5 4–5 5 Unsuitable 1 1 —	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
			NON-TEXTILE USAGE
			REACTIONS
		*Wool (2) and (3) similar Silk dyed metachrome has a somewhat redder hue	NOTES

C.I. Mordant Black	42	43	44
CHEMICAL CLASS		Azo	
C.I. CONSTITUTION NUMBER			
HUE: Daylight	Greenish Bluish Grey	Bluish Greenish Grey	Bluish Reddish Grey
Artificial light (tungsten)	Slightly redder	Somewhat redder	Slightly redder
DYEING: WOOL	1, 2, 3	1, 2	1, 2
Staining other fibres	All three methods give a white reserve on cellulose and silk	Afterchrome: Acetate—*ss*, Cellulose—*ss*, Silk—*ss* Metachrome: Acetate—*ss*, Cellulose—*hs*, Silk—*hs*	Afterchrome: Acetate—*hs*, Cotton—*ss*, Silk—*hs*, Viscose—*u* Metachrome: Acetate—*u*, Cotton—*ss*, Silk—*hs*, Viscose—*u*
DYEING: OTHER FIBRES		Nylon: Afterchrome	Nylon: Afterchrome
PRINTING			
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Wool (1)*	Wool (2)*	Wool (2)*
Alkali	—	5	5
Cross Dyeing Wool Acetic/Sulphuric	4/4	3–4/1–2	4–5/2
Carbonising	4–5	3	5
Chlorination	4–5	3–4	3–4
Decatising	4	4–5	4–5
Hot Pressing	—	5	5
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	4–5	6	6
normal	5	6–7	6–7
2× normal	6	7	7
Milling: Alkaline	4–5	5	4–5
Acid	4–5	—	—
Peroxide Bleaching	2	2–3	3
Perspiration	5	5	5
Potting	5	4	3–4
Sea Water	5	5	5
Stoving	5	4–5	4–5
Washing	5	5	5
Water	5	5	5
Dischargeability	—	—	—
Metal in dyebath: Copper	1	Marked change (1) Little change (2)	—
Iron	1	Strong change (1) Slight change (2)	—
Solubility	—	—	—
NON-TEXTILE USAGE			
REACTIONS			
NOTES	*Wool (2) and (3) similar	*Wool (1) very similar	*Wool (1) and (3) similar

45	46	47	C.I. Mordant Black
Oxazine	Azo	Azo	CHEMICAL CLASS
			C.I. CONSTITUTION NUMBER
Brownish Grey Little change	Reddish Grey Little change	Grey Little change	HUE: Daylight Artificial light (tungsten)
			DYEING: WOOL Staining other fibres
Cotton: Pad with chromium acetate	Cotton: Pad with Cr mordant	Silk: Chromium lactate Cotton: Pad with Cr mordant	DYEING: OTHER FIBRES
Wool: Chromium lactate Silk: Chromium lactate Cotton: Cr mordant	Wool: Chromium lactate Silk: Chromium lactate Cotton: Cr mordant	Wool: Chromium lactate Silk: Chromium lactate Cotton: Cr mordant	PRINTING

ISO Cotton	ISO Cotton	ISO Silk	ISO Cotton	FASTNESS PROPERTIES ETC.
—	—	—	—	Method
—	—	—	—	Substrate
—	—	—	—	Alkali
3*	4*	—	3–4*	Cross Dyeing Wool Acetic/Sulphuric
—	—	—	—	Carbonising
				Chlorination
—	—	—	—	Decatising
3–4	4–5	5–6	5–6	Hot Pressing
4	5	6	6	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
4–5	5	6–7	6–7	normal
—	—	4–5	—	2× normal
—	—	—	—	Milling: Alkaline
—	—	—	—	Acid
—	—	—	—	Peroxide Bleaching
—	—	5	—	Perspiration
—	—	—	—	Potting
—	—	—	—	Sea Water
—	—	—	—	Stoving
4 (40°C) 2–3 (100°C)	3 (40°C) 2 (100°C)	5	4–5 (40°C) 3–4 (100°C)	Washing
—	—	—	—	Water
Not dischargeable	Dischargeable to white	Dischargeable to white		Dischargeability
				Metal in dyebath: Copper
				Iron
				Solubility
				NON-TEXTILE USAGE
				REACTIONS
*Chlorine	*Chlorine	*Chlorine		NOTES

C.I. Mordant Black	48	49	50
CHEMICAL CLASS			Disazo
C.I. CONSTITUTION NUMBER			27270
HUE: Daylight	Black	Reddish Black	Black
Artificial light (tungsten)	Slightly redder	Unchanged	Little change
DYEING: WOOL	1	1, 3	1
Staining other fibres	Acetate—*ss* Cellulose—*ss* Silk—*s*	Afterchrome: Acetate—*ss–s*, Cotton—*u–ss*, Silk—*s* Mordant: Acetate—*ss*, Cellulose—*ss*, Silk—*hs*	Acetate—*u–ss* Cellulose—*u*
DYEING: OTHER FIBRES			Silk: Afterchrome
PRINTING	Vigoureux printing		
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Wool (1)	Wool	Wool (1) / Silk
Alkali	4–5	5	4 / —
Cross Dyeing Wool Acetic/Sulphuric	–/3–4	–/2	— / —
Carbonising	4–5	4–5	5 / —
Chlorination	—	—	— / —
Decatising	5	4–5	5 / —
Hot Pressing	5	4–5	5 / 3–4
Light: ⅓–½ normal	—	—	— / —
normal	6	6	6 / 5
2× normal	—	—	— / —
Milling: Alkaline	5	4	4–5 / 3
Acid	5	—	4 / —
Peroxide Bleaching	3–4	—	4 / 3
Perspiration	4–5	4–5	4 / 5
Potting	4	1–2	2 / —
Sea Water	5	4–5	4 / —
Stoving	5	4–5	4–5 / 2
Washing	5	4–5	4–5 / 4–5
Water	5	4–5	4–5 / 5
Dischargeability	—	—	—
Metal in dyebath: Copper	3	2–3	Unaffected
Iron	1	2	Unaffected
Solubility	—	Suitable for package dyeing	—
NON-TEXTILE USAGE			
REACTIONS			
NOTES			

51	52	53	C.I. Mordant Black
Monoazo	Monoazo		CHEMICAL CLASS
16510	**17520**		C.I. CONSTITUTION NUMBER
Black	Bluish Black	Bluish Black	HUE: Daylight
Little change	Much redder	Slightly duller	Artificial light (tungsten)
1	1	1	DYEING: WOOL
Acetate—*ss* Cotton—*ss* Silk—*hs* Viscose—*u*	Acetate—*hs* Cellulose—*hs* Silk—*hs*	Acetate—*ss* Cotton—*ss* Silk—*s* Viscose—*u*	Staining other fibres
			DYEING: OTHER FIBRES
			PRINTING
ISO Wool (1) 4 — 5 — 5 5 — 6 — 5 3 3–4 5 4 5 5 5 5 — Slight change Marked change Suitable for package dyeing	ISO Wool (1) 5 — 4–5 — 5 5 7 7–8 8 4–5 — 3 4–5 4 5 4–5 5 5 — — — —	ISO Wool (1) 4–5 –/3 5 — 5 5 — 6–7 — 5 4–5 3 4–5 4–5 5 5 5 5 — 3–4 2 —	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
			NON-TEXTILE USAGE
			REACTIONS
			NOTES

C.I. Mordant Black	54	55	56
CHEMICAL CLASS			Monoazo
C.I. CONSTITUTION NUMBER			16710
HUE: Daylight	Bluish Black	Bluish Black	Bluish Grey→Greenish Black
Artificial light (tungsten)	Slightly redder	Slightly duller	Little change
DYEING: WOOL	1	1	1
Staining other fibres	Acetate—*ss* Cotton—*ss* Silk—*s* Viscose—*u*	Acetate—*ss* Cotton—*ss* Silk—*s* Viscose—*u*	Acetate—*hs* Cellulose—*hs* Silk—*hs*
DYEING: OTHER FIBRES			
PRINTING	Wool: Cr mordant Vigoureux printing	Wool: Cr mordant Vigoureux printing	
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Wool (1)	Wool (1)	Wool (1)
Alkali	4–5	5	4–5
Cross Dyeing Wool Acetic/Sulphuric	–/3–4	–/3–4	–/2–3
Carbonising	4–5	5	4–5
Chlorination	—	—	—
Decatising	5	5	4–5
Hot Pressing	5	5	4–5
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	—	—	4–5
normal	6	6	5
2× normal	—	—	5–6
Milling: Alkaline	5	5	4–5
Acid	4–5	4–5	—
Peroxide Bleaching	4	3	2
Perspiration	5	4–5	4–5
Potting	4–5	3–4	3
Sea Water	5	5	4–5
Stoving	4–5	4	4
Washing	5	5	4–5
Water	5	5	5
Dischargeability	—	—	—
Metal in dyebath: Copper	2–3	2–3	Redder
Iron	2	2	Brown
Solubility	Suitable for package dyeing	—	Suitable for package dyeing
NON-TEXTILE USAGE		Hat dyeing	Leather: Glove leather
REACTIONS			
NOTES			

57	58	59	C.I. Mordant Black
Anthraquinone 63620			CHEMICAL CLASS C.I. CONSTITUTION NUMBER
Black	Bluish Black Duller	Black Little change	HUE: Daylight Artificial light (tungsten)
1 Acetate—*hs* Cellulose—*ss* Silk—*hs*	1 Acetate—*ss* Cellulose—*u* Silk—*ss*	1 Acetate—*ss* Cotton—*ss* Silk—*s* Viscose—*u*	DYEING: WOOL Staining other fibres
			DYEING: OTHER FIBRES
Wool: Cr mordant	Wool: Cr mordant Vigoureux printing		PRINTING
ISO Wool (1) 5 — 5 — 5 5 — 5–6 — 5 4 4 4–5 4–5 4–5 4 5 4–5 Not dischargeable to white Somewhat bluer Somewhat redder —	ISO Wool (1) 4–5 — 4–5 — 4–5 5 — 6 — 4 4–5 4 5 3 5 — 4 5 — 2 2 —	ISO Wool (1) 5 –/3 5 — 5 5 — 6 — 5 4–5 3 5 3–4 5 4 5 5 — 3–4 3–4 —	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
		Hat dyeing	NON-TEXTILE USAGE
			REACTIONS
	Stains silk blue		NOTES

C.I. Mordant Black	60	61	62
CHEMICAL CLASS			Disazo
C.I. CONSTITUTION NUMBER			26750
HUE: Daylight	Black	Black	Black
Artificial light (tungsten)	Little change	Little change	Little change
DYEING: WOOL	1, requires little chrome	1	1, penetration excellent
Staining other fibres	Acetate—*ss* Cellulose—*ss* Silk—*s*	Acetate—*s* Cellulose—*ss* Silk—*s*	Acetate—*u* Cellulose—*ss* Silk—*hs*
DYEING: OTHER FIBRES			
PRINTING		Wool: Cr mordant Vigoureux printing	
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Wool (1)	Wool (1)	Wool (1)
Alkali	4–5	4–5	5
Cross Dyeing Wool Acetic/Sulphuric	–/3–4	–/3	–/5
Carbonising	4–5	5	—
Chlorination	—	—	—
Decatising	5	5	4–5
Hot Pressing	5	5	5
Light: ⅓–½ normal	—	—	—
normal	7	5–6	5
2× normal	—	—	—
Milling: Alkaline	5	5	4
Acid	5	4–5	4
Peroxide Bleaching	3–4	4	2–3
Perspiration	5	5	4–5
Potting	4–5	3–4	2–3
Sea Water	5	4–5	5
Stoving	5	5	5
Washing	5	5	5
Water	5	5	5
Dischargeability	—	—	—
Metal in dyebath: Copper	3	4	Little altered
Iron	1–2	3–4	Little altered
Solubility	—	—	—
NON-TEXTILE USAGE			
REACTIONS			
NOTES			

63	64	65	C.I. Mordant Black
		Monoazo	CHEMICAL CLASS
		18170	C.I. CONSTITUTION NUMBER
Reddish Black Redder	Violet Grey→Black Duller	Bluish Grey→Bluish Black Slightly greener	HUE: Daylight Artificial light (tungsten)
1 Acetate—*ss* Cellulose—*ss*	1, 2 Afterchrome: Acetate—*u*, Cellulose—*u*, Silk—*hs*	1, 2 Afterchrome: Acetate—*u*, Cellulose—*u*, Silk—*hs*	DYEING: WOOL Staining other fibres
Silk: Afterchrome			DYEING: OTHER FIBRES
	Vigoureux printing	Wool: Cr mordant Vigoureux printing	PRINTING
ISO Wool (1) 4–5 –/2 4–5 — 5 5 6 7 — 5 — — 5 4 5 4–5 5 5 — 2 2 Suitable for package dyeing	ISO Wool (1) 5 –/4 5 — 4–5 5 5 6 6–7 5 4–5 4 5 4–5 5 5 5 5 — 2–3 1–2 —	ISO Wool (1) 5 –/4 5 — 4–5 5 5 6 6–7 5 4–5 3–4 5 4–5 5 5 5 5 — 3 1–2 —	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
			NON-TEXTILE USAGE
			REACTIONS
			NOTES

C.I. Mordant Black	66	67	68
CHEMICAL CLASS	Monoazo		Disazo
C.I. CONSTITUTION NUMBER	17525		26751
HUE: Daylight	Bluish Black	Reddish Navy→Bluish Black	Black
Artificial light (tungsten)	Slightly greener	Redder	Little change
DYEING: WOOL	1	1, 3	1
Staining other fibres	Acetate—*ss* Cotton—*ss* Silk—*hs* Viscose—*u*	Afterchrome: Acetate—*s*, Cotton—*vss*, Silk—*ss*	Acetate—*ss* Cellulose—*ss* Silk—*hs*
DYEING: OTHER FIBRES			
PRINTING	Vigoureux printing		
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Wool (1)	Wool (1)	Wool (1)
Alkali	5	4	5
Cross Dyeing Wool Acetic/Sulphuric	–/3	–/3	—
Carbonising	4–5	5	5
Chlorination	—	—	—
Decatising	5	5	4–5
Hot Pressing	5	4–5	5
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	—	—	—
normal	6	5–6	5
2× normal	—	7	—
Milling: Alkaline	5	5	4
Acid	5	3–4	4
Peroxide Bleaching	3	—	3
Perspiration	5	5	4–5
Potting	4	4	3
Sea Water	4–5	—	5
Stoving	3	4	4
Washing	5	5	5
Water	5	—	5
Dischargeability	—	3	—
Metal in dyebath: Copper	2–3	4–5	Unaltered
Iron	1	3	Somewhat redder
Solubility	—	—	—
NON-TEXTILE USAGE			Leather
REACTIONS			
NOTES	Becomes redder on fading		

69	70	71	C.I. Mordant Black
Monoazo ▪			CHEMICAL CLASS C.I. CONSTITUTION NUMBER
Reddish Black Redder	Black No change	Dull Black Brighter	HUE: Daylight Artificial light (tungsten)
1, requires little chrome Acetate—*hs* Cellulose—*hs*	1 Acetate—*ss* Cellulose—*ss* Silk—*hs*	1, needs little chrome Acetate—*ss* Cellulose—*u* Silk—*s*	DYEING: WOOL Staining other fibres
			DYEING: OTHER FIBRES
			PRINTING
ISO Wool (1) 4–5 — 4–5 — 4–5 5 — 6 — 4 — — 4–5 — 4–5 4 4–5 4–5 — — — —	ISO Wool (1) 5 3–4/2–3 5 4–5 5 5 — — 7 5 4 2–3 5 4–5 5 4–5 5 5 — 4 1 —	ISO Wool (1) 4–5 — 5 — 5 5 — 7 — 5 4–5 4–5 5 4 5 4–5 5 5 — — — —	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
			NON-TEXTILE USAGE
			REACTIONS
***Manufacture:** 2-Amino-4-nitrophenol→ aminonaphtholsulphonic acid			NOTES

C.I. Mordant Black	72	73	74
CHEMICAL CLASS			Disazo
C.I. CONSTITUTION NUMBER			27740
HUE: Daylight	Bluish Black	Black	Bluish Black
Artificial light (tungsten)	Duller and redder	Little change	Unaltered
DYEING: WOOL	1	1	■
Staining other fibres	Acetate—*s* Cotton—*s* Silk—*s* Viscose—*u*	Acetate—*ss* Cotton—*ss* Silk—*s* Viscose—*u*	
DYEING: OTHER FIBRES			
PRINTING	Wool: Cr mordant Vigoureux printing		
FASTNESS PROPERTIES ETC.			
Method	ISO	ISO	ISO
Substrate	Wool (1)	Wool (1)	Wool–Cellulose mixture
Alkali	5	4–5	5
Cross Dyeing Wool Acetic/Sulphuric	—	—	—
Carbonising	5	5	—
Chlorination	—	—	—
Decatising	5	5	4–5
Hot Pressing	5	5	4
Light: ⅓–½ normal	—	—	—
normal	6	6	6–7
2× normal	—	—	—
Milling: Alkaline	5	5	4–5
Acid	4	4–5	—
Peroxide Bleaching	3–4	2	4–5
Perspiration	5	5	5
Potting	4	5	—
Sea Water	5	5	5
Stoving	5	—	4–5
Washing	5	5	4–5
Water	5	5	5
Dischargeability	—		Not dischargeable to white
Metal in dyebath: Copper	Unchanged		Unaffected
Iron	Destroyed		Unaffected
Solubility	—		Very good
NON-TEXTILE USAGE			
REACTIONS			
NOTES			*Wool–Cellulose mixtures: Apply as a direct dye, diazotise, treat in cold ammonia and finally chrome in an acetic acid bath. Can be used as a direct dye but fastness is not as good especially to decatising and water **Literature:** *BIOS Misc.* 20, Appendix 32 *GP* 710,395

75	76	C.I. Mordant Black
		CHEMICAL CLASS
		C.I. CONSTITUTION NUMBER
Black		HUE: Daylight Artificial light (tungsten)
		DYEING: WOOL Staining other fibres
		DYEING: OTHER FIBRES
		PRINTING
		FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
Anodised aluminium. Fastness: Light 8; Weather, very good; Heat (*a*) 6 h at 200°C turns dull bordeaux, (*b*) 1 h at 250°C turns dull bordeaux	Anodised aluminium. Fastness: Light 7; Weather, very good; Heat (*a*) 6 h at 200°C turns dull bordeaux, (*b*) 1 h at 250°C turns pale bordeaux	NON-TEXTILE USAGE
		REACTIONS
		NOTES

C.I. Mordant Black	77	78	79
CHEMICAL CLASS		Monoazo	Monoazo
C.I. CONSTITUTION NUMBER			
HUE: Daylight	Bluish Black	Black	Bluish Grey
Artificial light (tungsten)			
DYEING: WOOL		1	1
Staining other fibres		Acetate—*s* Cotton—*s* Nylon—*hs* Silk—*hs*	Acetate—*ss* Cotton—*ss* Nylon—*hs* Silk—*hs*
DYEING: OTHER FIBRES			
PRINTING			
FASTNESS PROPERTIES ETC.			
Method		ISO	ISO
Substrate		Wool (1)	Wool (1)
Alkali		4–5	3–4
Cross Dyeing Wool Acetic/Sulphuric		—	—
Carbonising		4–5	4
Chlorination		—	—
Decatising		5	4–5
Hot Pressing		5	4–5
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal		—	6
normal		7	6–7
2× normal		—	7
Milling: Alkaline		4–5	4
Acid		—	—
Peroxide Bleaching		4–5	2–3
Perspiration		5	5
Potting		4–5	4
Sea Water		5	5
Stoving		5	4–5
Washing		5	4
Water		5	5
Dischargeability		—	—
Metal in dyebath: Copper		3–4	1
Iron		4–5	2
Solubility		Excellent	Very good
NON-TEXTILE USAGE	Anodised aluminium. Fastness: Light 8; Weather, very good; Heat (*a*) 6 h at 200°C turns dull bordeaux (*b*) 1 h at 250°C turns pale bordeaux		
REACTIONS			
NOTES		**Literature** *FP* 1173832 *Belg. P* 566096	**Literature** *FP* 11173833 *Belg. P* 566852

80	81	82	C.I. Mordant Black
Monoazo	Monoazo	Azo	CHEMICAL CLASS
			C.I. CONSTITUTION NUMBER
Reddish Black	Reddish Grey	Navy→Black	HUE: Daylight
Unchanged	Slightly yellower		Artificial light (tungsten)
1	1, 2	1	DYEING: WOOL
Acetate—*u* Acrylic—*u* Polyester—*vss* Viscose—*u*	Afterchrome: Acetate—*hs*, Cotton—*ss* Metachrome: Acetate—*hs*, Cotton—*hs*	Acetate—*s* Cellulose—*u* Nylon—*s* Silk—*s*	Staining other fibres
	Silk: Afterchrome, Metachrome		DYEING: OTHER FIBRES
			PRINTING
ISO Wool (1)	ISO Wool (1) Wool (2)	ISO Wool (1)	FASTNESS PROPERTIES ETC. Method
4–5	4 4	5	Substrate
—	–/5 –/5	–/2	Alkali
5	4–5 4–5	4–5	Cross Dyeing Wool Acetic/Sulphuric
5	— —	5	Carbonising
5	4–5 5	4–5	Chlorination Decatising
4	4 4	4	Hot Pressing
—	5 5	—	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
7–8	5–6 5–6	6–7	normal
—	6–7 6–7	—	2× normal
5	4 4	4–5	Milling: Alkaline
5	— —	3–4	Acid
—	5 3–4	4	Peroxide Bleaching
4	5 4–5	5	Perspiration
5	4 3	4–5	Potting
4–5	5 5	5	Sea Water
5	4 4–5	—	Stoving
4–5	4–5 4	4–5	Washing
—	5 5	5	Water
—	—	Not dischargeable to white	Dischargeability
4–5	Becomes violet (1 and 2)	Little redder	Metal in dyebath: Copper
5	Duller (1), Redder and duller (2)	Destroyed	Iron
Very good	Sol. in hot and cold water	—	Solubility
			NON-TEXTILE USAGE
	In substance: H_2SO_4 conc.—bordeaux, on diln—bright reddish violet		REACTIONS
			NOTES

C.I. Mordant Black	83	84	85
CHEMICAL CLASS	Monoazo	Azo	Azo
C.I. CONSTITUTION NUMBER			
HUE: Daylight	Bluish Grey	Bluish Black	Bluish Black
Artificial light (tungsten)	Duller		
DYEING: WOOL	1, 2	1, 3	1, 3
Staining other fibres	Afterchrome: Acetate—*s*, Cellulose—*u*, Silk—*s* Metachrome: Acetate—*u*, Cellulose—*u*, Nylon—*hs*, Silk—*s*	Acetate—*u* Acrylic—*u* Cellulose—*u* Nylon—*vhs–d* Polyester—*u* Silk—*vhs–d*	Acetate and Acrylic—*hs–d* Cotton—*hs* Nylon—*d* Polyester—*ss–s* Silk—*d*
DYEING: OTHER FIBRES	Nylon: Afterchrome, Mordant		
PRINTING	Nylon: Direct and coloured discharge Wool: Direct, coloured discharge and Vigoureux Cotton: Direct		Vigoureux printing

FASTNESS PROPERTIES ETC.

Method	ISO			ISO	ISO
Substrate	Wool (1)	Wool (2)	Nylon	Wool (1)	Wool (1)
Alkali	4–5	5	—	4–5	5
Cross Dyeing Wool Acetic/Sulphuric	4/4	3–4/3–4	—	—	—
Carbonising	4	4	—	4–5	4–5
Chlorination	5	5	—	—	—
Decatising	5	5	—	4	3–4
Hot Pressing	5	5	—	—	—
Light: ⅓–½ normal	5–6	5–6	5	—	—
normal	6–7	6–7	6	7	7–8
2× normal	7	7	6–7	—	—
Milling: Alkaline	4–5	5	—	4–5	4–5
Acid	4	4–5	—	—	—
Peroxide Bleaching	2–3	3	—	4–5	5
Perspiration	5	5	5	5	5
Potting	4	4–5	4	4–5	5
Sea Water	5	5	—	5	5
Stoving	4	4	—	—	—
Washing	4–5	5	5	5	5
Water	5	5	—	5	5
Dischargeability		—		—	—
Metal in dyebath: Copper	Becomes violet			3–4	4–5R
Iron	Becomes brown			1	1
Solubility		—		101 g/l at 80°C	41 g/l at 80°C

NON-TEXTILE USAGE			
REACTIONS			
NOTES	Levelling is very good		

86	87	88	C.I. Mordant Black
Azo	Azo	Disazo	CHEMICAL CLASS
			C.I. CONSTITUTION NUMBER
Bluish Black	Black	Black	HUE: Daylight
			Artificial light (tungsten)
1, 3	1		DYEING: WOOL
Acetate—*u* Acrylic—*u* Cellulose—*u* Nylon—*vhs–d* Polyester—*u* Silk—*vhs–d*			Staining other fibres
	Nylon: Afterchrome Silk: Afterchrome		DYEING: OTHER FIBRES
		Cotton: Chromium acetate. May be used alongside azoic, soluble vat and reactive dyes	PRINTING
ISO		ISO	FASTNESS PROPERTIES ETC.
Wool (1)		Cotton	Method
5		—	Substrate
—		—	Alkali
4–5		—	Cross Dyeing Wool Acetic/Sulphuric
—		—	Carbonising
3–4		—	Chlorination
			Decatising
—		—	Hot Pressing
—		—	Light: $\frac{1}{3}$–$\frac{1}{2}$ normal
7–8		6–7	normal
—		—	2× normal
4–5		—	Milling: Alkaline
—		—	Acid
4–5		—	Peroxide Bleaching
5		—	Perspiration
4–5		—	Potting
5		—	Sea Water
—		—	Stoving
5		4–5	Washing
5		—	Water
—		Poor	Dischargeability
4		—	Metal in dyebath: Copper
4–5		—	Iron
15 g/l at 80°C		Good	Solubility
			NON-TEXTILE USAGE
			REACTIONS
			NOTES

C.I. Mordant Black	89	90	91
CHEMICAL CLASS	Oxazine	Disazo (metal complex)	
C.I. CONSTITUTION NUMBER			
HUE: Daylight	Black	Bluish Grey	Bluish Black
Artificial light (tungsten)			
DYEING: WOOL			
Staining other fibres			
DYEING: OTHER FIBRES			
PRINTING	Wool: Chromium acetate Silk: Chromium acetate Cellulose: Chromium acetate May be used in neutral discharge printing		
FASTNESS PROPERTIES ETC.			
Method	ISO		
Substrate	Cellulose		
Alkali	—		
Cross Dyeing Wool Acetic/Sulphuric	—		
Carbonising	—		
Chlorination	—		
Decatising	—		
Hot Pressing	—		
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	—		
normal	6		
2× normal	—		
Milling: Alkaline	—		
Acid	—		
Peroxide Bleaching	—		
Perspiration	—		
Potting	—		
Sea Water	—		
Stoving	—		
Washing	4–5		
Water	—		
Dischargeability	Not dischargeable		
Metal in dyebath: Copper	—		
Iron	—		
Solubility	Good		
NON-TEXTILE USAGE		Anodised aluminium Fastness to light 5	Anodised aluminium Fastness: Light 8; Weather, very good
REACTIONS			
NOTES			

92	93	94	C.I. Mordant Black
Monoazo	Monoazo	Monoazo	CHEMICAL CLASS
	16575	*	C.I. CONSTITUTION NUMBER
Black Redder	Blue→Black	Black Greener	HUE: Daylight Artificial light (tungsten)
1, 2 Acetate—4 Cotton—4 Nylon—*d* Silk—*d* Viscose—4–5 Terylene—4	1	Padded with chromium fluoride and steamed Cellulose: slightly stained	DYEING: WOOL Staining other fibres
Nylon: Afterchrome		Silk: as wool	DYEING: OTHER FIBRES
Vigoureux printing		Wool: Vigoureux printed with chromium fluoride	PRINTING
ISO Wool (1) Nylon 4–5 4–5 — — 4 — 4 4–5 — — — — 5–6 5 6 5–6 6–7 6 5 5 — — 5 5 5 5 4–5 4–5 5 5 5 — 5 5 5 5 4–5 (wool) 4 (nylon) — — 30 g/l	ISO Wool (1) 3–4 — 4–5 — 4 — — 6–7 — 1–2 — — 4 2–3 4–5 4–5 4 —	ISO Wool (CrF_3) 3–4 4–5/4 4–5 5 4 5 — 7 — 4–5 4–5 4–5 5 5 4–5 4 4–5 5	FASTNESS PROPERTIES ETC. Method Substrate Alkali Cross Dyeing Wool Acetic/Sulphuric Carbonising Chlorination Decatising Hot Pressing Light: $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Milling: Alkaline Acid Peroxide Bleaching Perspiration Potting Sea Water Stoving Washing Water Dischargeability Metal in dyebath: Copper Iron Solubility
Leather: On chrome and vegetable tannages			NON-TEXTILE USAGE
		In substance: H_2SO_4 conc. —violet, on diln—brownish	REACTIONS
	For use as an acid dye see C.I. Acid Red 176	Not suitable for conventional dyeing methods *Similar to C.I. 15710	NOTES

C.I. Mordant Black	94:1	
CHEMICAL CLASS	Monoazo	
C.I. CONSTITUTION NUMBER	*	
HUE: Daylight	Black	
Artificial light (tungsten)	Greener	
DYEING: WOOL	Padded with chromium fluoride or formate and steamed	
Staining other fibres	Cellulose—*ss*	
DYEING: OTHER FIBRES	Silk: as wool	
PRINTING	Vigoureux printing with chromium fluoride	
FASTNESS PROPERTIES ETC.		
Method	ISO	
Substrate	Wool (chromium formate)	
Alkali	3–4	
Cross Dyeing Wool Acetic/Sulphuric	4–5/4	
Carbonising	4–5	
Chlorination	5	
Decatising	4	
Hot Pressing	5	
Light: $\frac{1}{3}$–$\frac{1}{2}$ normal	—	
normal	7	
2× normal	8	
Milling: Alkaline	4–5	
Acid	4–5	
Peroxide Bleaching	4–5	
Perspiration	5	
Potting	5	
Sea Water	4–5	
Stoving	4–5	
Washing	4–5	
Water	4–5	
Dischargeability		
Metal in dyebath: Copper		
Iron		
Solubility		
NON-TEXTILE USAGE		
REACTIONS	In substance: H_2SO_4 conc.—violet, on diln —brownish	
NOTES	Not suitable for conventional dyeing methods	
	*Similar to C.I. 15710	

NATURAL DYES AND PIGMENTS

These dyes and pigments comprise all those that are obtained from animal or vegetable matter with no or very little chemical processing. They are mainly mordant dyes but include some vat dyes, a few solvent dyes, some pigments, some direct and acid dyes. Only one natural basic dye is known and there is no natural sulphur, disperse, azoic or ingrain dye, or oxidation base.

The colouring matters dealt with here are those that have at some time attained some importance as colouring matters for textiles or other substrates. There are numerous other colouring matters known to occur in animal or vegetable matter, some being of immense importance biologically or botanically, but as they have found little or no use as dyes or pigments they were considered to be outside the scope of this Index.

The natural colorants are arranged in hue order, irrespective of their mode of application. Many natural dyes are mixtures of two or more colouring matters and so bear more than one Part II number, these numbers being placed in the order of importance of the components of the dye.

Although most of the natural dyes have now little or no commercial use in modern industry some are still in use in home industries, and by handicraft workers.

Until Perkin in the middle of the 19th century commenced to produce dyes on a commercial scale from coal tar practically all the dyes and pigments in use came from vegetable or animal sources or from inorganic sources. Thus the whole of the literature on the application of colouring matters and pigments published before 1862, in which year F. Crace-Calvert's *Lectures on coal-tar colours, and on recent improvements in dyeing and calico-printing embodying copious notes taken at the London Exhibition of 1862 with numerous dyed patterns* (Manchester 1862, another edition 1865) was published, dealt solely with natural or inorganic dyes or pigments. To this day some of the natural dyes and pigments, e.g. Logwood, Osage Orange and Bitumen, retain much of their old importance.

LITERATURE

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Young, S., *Navajo Native Dyes*, U.S. Office of Indian Affairs (1940)

C.I. 75580

The dried flower heads of Roman and Greek chamomiles much used as a pale yellow dye in hair washes, etc., especially for blonde hair and in combination with henna

Literature

Roumanian Standard STAS 937

C.I. 75590, 75580

The extract of the Dyer's Rocket, *Reseda luteola* L., found in many parts of Central Europe and formerly cultivated in England, France, Germany and Austria

At one time of considerable importance for yellows on alum mordanted silk, being specified in Government contracts for gold braid. Had a limited use on wool (yellow on alum, yellowish olive on chrome, olive on iron and greenish yellow on tin mordant). Has poor colour value compared with Fustic, Quercitron Bark, etc., but reputed to yield the purest dyeings and best fastness to light of any natural yellow. Perhaps the oldest European dye, being used by the Gauls. Still used in some parts of Europe for dyeing leather

Weld Lake, formerly used in oil or size or as a water colour, was prepared by treating an aqueous extract of weld with alum and then precipitating with soda—*Bersch*, 349

Sawwort or *Serratula tinctoria* L. is a plant yielding a yellow nearly of the same nature as Weld for which it is a good substitute (*Encyclopaedia Britannica*, **17** (1796), 616). It has a high tannin content and was used to produce blacks on an iron mordant

Reactions

H_2SO_4 conc.—olive yellow
NaOH—fibre unchanged, solution pale yellow

Literature

Parnell, 38
Napier, 345
Muspratt, 633
Hummel, 356
Manual, 354
P & E, 158
Gallotti, *Ciba Rev.*, **2** (1939) 750

C.I. 75300

The ground root or underground stem of various species of *Curcuma* grown in S. Asia, Chinese Turmeric, from *C. longa*, being the best quality. Dyes cotton, wool and silk directly to a greenish yellow or orange yellow on an alum, brown on a chrome, brownish black on an iron and orange red on a tin mordant. As a direct dye it is applied alone or with a little alum, acid or acid salt. The bath must not be alkaline and must not be above 60°C or the dyeing will lose in brightness and depth. Fastness to light, washing and alkali is poor but it is still extensively used in China and India. It is used as a food dye and for colouring oils, waxes, etc. Also used for shading Logwood on skin rugs and as a sensitive indicator for alkalis and as a stain in microscopy

Reactions

H_2SO_4—fibre and solution red brown; on dilution—fibre pale straw, solution colourless
HCl—fibre reddish brown, solution pale pink; on dilution—fibre pale yellow
HNO_3—deep red, then yellow
NaOH—fibre and solution bright reddish orange

Literature

Napier, 347
Hummel, 367
Stansfield, *JSDC Jubilee Issue* (1934) 139
Gallotti, *Ciba Rev.*, **2** (1939) 751
Bühler, *ibid.*, **6** (1948) 2488
Rotheman, *Seifen-Öle-Fette-Wachse*, **75** (1949) 542
Phadke, 13, 37
Srinivasan, *Current Sci.*, (India), **21** (1952) 311
Bhattacharya, 16

Direct dyeings of Gunari on cotton and wool have poor fastness to washing but applied on a mordant it is fast to washing. Used in Burma together with Safflower, C.I. Natural Red 26, and in India with Turmeric, C.I. Natural Yellow 3; cf. Asbarg, C.I. Natural Yellow 10

Obtained by aqueous extraction of the corolla of the safflower, its composition is $C_{14}H_{16}O_7$ but its constitution is unknown. Used for colouring liqueurs

Literature

Schliefer, *Ann.*, **58** (1864) 357
Malin, *Ann.*, **136** (1865) 117
P & E, 594
Mayer & Cook, 208
Cross, *Thorpe*, **10**, 653

C.I. Natural Yellow 6

C.I. 75100

Saffron is the dried stigma of the flowers of saffron, *Crocus sativus* L., a species of iris grown in Afghanistan, Cashmere and Spain
Unki is the fruit of *Gardinia florida* L. grown in the E. Indies
Wongshy or **Wongsky** is the fruit of *G. grandiflora* L.
Dyes silk and wool directly golden yellow and orange respectively; tin mordanted cotton is dyed orange

Saffron was formerly used in England for dyeing silk and glove leather; it is still used to some extent in India on textiles. It is also used as a food dye. Wongsky is used in China for yellows, as a component of greens and in conjunction with safflower. Used in Burma together with safflower for dyeing textiles: combined with turmeric used to produce the sulphur yellows or *basanti* of Cawnpore. Unki is used as a constituent of scarlets. Fastness to washing is poor; fastness to light on silk is good but is poor on other fibres

Literature

Bancroft, 285
Napier, 377
Muspratt, 634
Slater, 83 (Gardenia Pods), 230 (Wongshy)
Hayashi, *Proc. Imp. Acad.* (Tokyo), **20** (1944) 311

C.I. Natural Yellow 7

The rind of *Punica granatum* L. cultivated in India where it is used as a direct cotton dye being applied from a sodium carbonate bath often in conjunction with other yellow or orange dyes, e.g. turmeric or safflower, for which it seems to act as a mordant giving faster dyeings. It contains granatonine and much tannin. Dyes violet on an iron mordant
Pomegranate Flowers are used as a red dye in parts of India

Literature

Shroff and Trivedi, *J. Indian Chem. Soc.*, Ind. Ed., **3** (1940) 109, 127
Phadke, 128
Bhattacharya, 18
Slater, 158
Schmidt and Fickert, *Z. Naturf.*, **13b** (1958) 136
Andrä, *Diss.*, Heidelberg 1963

C.I. Natural Yellow 8

C.I. 75660

Obtained from the wood of the osage orange tree, *Maclura pomifera*, indigenous to the U.S.A. (Texas, Oklahoma, Louisiana, Mississippi and Pennsylvania), the aqueous extract having a tannin content of 25–42% depending upon the quality of the wood and temperature of extraction—*USP* 1,263,126. Its dyeing properties are similar to those of Old Fustic, C.I. Natural Yellow 11, but it yields clearer, less reddish dyeings of better fastness to light. Widely used in the U.S.A. on chrome mordanted wool and nylon, tin weighted silk and chromed leather. Fastness on chrome mordanted nylon (A.A.T.C.C. tests) light 8, washing 5, perspiration 5. Nylon dyed with Osage Orange shows less loss in tensile strength than with any other dyewood. Much used in conjunction with logwood, C.I. Natural Black 1. Its high tannin content has led to its being used to replace Gambier, C.I. Natural Brown 3, on silk and leather

Literature

Barnes & Gerber, *J. Amer. Chem. Soc.*, **77** (1955) 3260

C.I. Natural Yellow 9

Quercitron Lake (a) Clarify a fresh extract of Quercitron Bark* with a little gelatin solution, add alum and precipitate with chalk, or (b) add castor oil, stannous chloride and aluminium sulphate to Quercitron Bark extract and precipitate with chalk to produce transparent olive yellows
Bismarck or **Bronze Lake** is a yellowish-brown lake with a greenish cast obtained by using alum, copper and iron
Leather Lake is the deep brownish-yellow copper lake with a greenish cast

The lakes are unstable at high temperatures, have poor fastness to light and are slightly affected by sulphur dioxide. The alum lake is unaffected by hydrogen sulphide. They retain their intensity better in artificial light than the lakes of other natural yellows and so are used for internal decoration of theatres, etc.

Quercitron Lake is used for making green lakes by precipitating a green basic dye upon it with tannin and tartar emetic

Bismark, Bronze and Leather Lakes are used mainly for colouring paper and in wallpaper printing

*Brighter lakes result from use of **Flavine** and similar lakes with Young Fustic

Reactions

Soluble in alkalis, the lakes are regenerated from the yellowish brown solution by aluminium sulphate thus distinguishing them from the lakes of synthetic yellows. Decomposed or decolorised by mineral acids

Literature

Bersch, 351
Zubulen, *Bull. Soc. Ind. Mulhouse*, **84** (1919) 511
Remington and Jones, *Pigments*, 3rd Ed. (London 1954) 198

C.I. 75570, 75640, 75670, 75680, 75710, 75720, 75730, 75750

Quercitron Bark is the ground inner bark of *Quercus tinctoria* Willd., an oak indigenous to Pennsylvania, Georgia and Carolina. **Bark Liquor** is its aqueous extract

Patent Bark or **Quercetin industrielle** (manufactured by Leeshing in 1855) is obtained by boiling Quercitron Bark with dilute sulphuric acid and is thrice as strong as the bark

Flavine yellow shade is prepared by extracting the bark with high pressure steam and consists mainly of quercitrin, C.I. 75720. It yields golden yellow on alum, brownish yellow on chrome, lemon yellow on tin and deep olive on iron mordants. Formerly used on wool mordanted with tin and alum in a single bath to produce brilliant yellows which could not be matched with yellow synthetic acid dyes because of the physical difference between the two dyeings. The flavine lake is very opaque whereas yellow acid dyes are transparent. Thus wool dyed with the flavine lake reflects more light than that dyed with a yellow acid dye and has a degree of luminosity not unlike that of the modern fluorescent printing pigments

Flavine red shade is prepared by rapidly extracting the bark with dilute ammonia and boiling the extract with sulphuric acid, it consists mainly of quercetin, C.I. 75670. It yields brownish orange on alum, reddish brown on chrome, olive black on iron and bright orange brown on tin mordants. The Flavines have approximately 16 times the colour value of the bark

Clover Flowers were formerly used for dyeing yellows

Asbarg, the aqueous extract of the dried flowers and stalks of *Delphinium zalil* cultivated in Baluchistan and Persia, formerly much used in India for producing *gand kaki,* a sulphur yellow, on silk and together with Akalbir, C.I. Natural Yellow 12, to produce a similar hue on alum mordanted silk; it was also much used in calico printing. Its dyeings have poor fastness, on alum they are purer and less orange than Quercitron Bark, cf. C.I. Natural Yellows 4, 5 and 6

Quercitron Bark gives dyeings somewhat yellower and duller than Persian Berries. On chrome mordanted wool or nylon it yields brownish olives, on an alum mordant it is dull yellow, on iron greenish olive and on tin dull reddish yellow. It is used chiefly for steam olives and browns on chrome in calico printing and for shading logwood printing blacks. Also used for dyed styles on printed or discharged mordants. Flavine on wool gives bright yellows and oranges fast to milling, once largely used with cochineal for bright scarlets. Fastness, Quercitron Bark printed on cotton with chrome acetate (S.D.C. tests)—Light 7, washing test No. 1—5, 4; No. 2—4–5, 3–4. On alum or tin of poor fastness to light and washing. On wool and silk the chrome, iron and copper lakes are fairly fast and the alum and tin lakes moderately fast. Quercitron Bark has limited use on leather for grounds to be topped with synthetic dyes

Buckwheat or **Rue** obtained from *Ruta graveolens* L. dyes brown direct but green on iron mordant and consists mainly of rutin, C.I. 75730

Discoverer—Bancroft, 1784

Reactions (Quercitron Bark)

HCl conc.—fibre dull yellow, solution yellow
HNO_3 conc.—fibre brownish yellow, solution straw coloured
NaOH 10%—fibre brownish yellow, solution yellow

Literature

Bancroft, *Philosophy of Permanent Colours*, **2** (1813) 113
Napier, 341, 344
Muspratt, 36
Hummel, 362
Manual, 353
P & E, 175
Attree and Perkin, *J.C.S.* (1927) 239
Mayer & Cook, 188, 211
Knecht & Fothergill, 304, 469, 842
Phadke, 14, 24, 124

C.I. 75240, 75660

The wood of the trunk of *Chlorophora* (or *Morus* or *Maclura*) *tinctoria* Gaud., a tree found throughout the Americas and exported mainly from Costa Rica, Jamaica, Colombia, Nicaragua, Panama, Salvador and Venezuela. The Cuban is the best. Used mainly for shading logwood blacks on chrome mordanted wool or iron mordanted silk and to some extent for shading chrome browns on wool and cutch browns on cotton. Protects chrome-mordanted nylon against degradation by light. Fastness on wool (2% dyeing) in milling—good, potting—good, light—moderate, on alum and tin fastness to light is poor. Fastness on chromed nylon (A.A.T.C.C. tests): light 8, washing 5, perspiration 5. Used on chrome leather and to a less extent on vegetable tanned leather, as ground and mordant for topping with synthetic dyes

Jak-wood or **Kanthal,** the wood of *Artocarpus integrifolia* grown in Burma and India differs from Old Fustic in containing morin, C.I. 75660, as its sole colouring matter—*P & E*, 218

Redoul or **Rodou,** the leaves of *Rhus mytifolia*, was used in S. France *c.* 1853 as a substitute for Old Fustic

Fustic Lake was the alum or lead salt of Fustic—*Bersch*, 351

Reactions (on chromed wool)

H_2SO_4 conc.—slowly becomes browner
HCl conc.—unaffected
HNO_3 conc.—fibre brown, solution almost colourless
NaOH 10%—fibre slightly redder, solution pale yellow

Literature

Parnell, 34
Napier, 339
Muspratt, 579
Slater, 78
Hummel, 359
Manual, 349
Bhattacharya, 15
Stansfield, *JSDC*, *Jubilee Issue* (1934) 139
Bird and Newsome, *JSDC*, **66** (1950)
Tidsdale, *Rayon & Synthetic Textiles*, **32** (6) (1951) 59
Parsy, *Teintex*, **20** (1955) 867, 951

C.I. Natural Yellow 12

C.I. 75630

The roots of the Bastard Hemp, *Datisca cannabina* L., formerly extensively used in Cashmere and throughout the Himalayas on alum-mordanted silk. Dyes wool very much like Fustic, C.I. Natural Yellow 11, but has less colour value. On cotton dyes more like Quercitron Bark, C.I. Natural Yellow 10

Literature

P & E, 620
Mayer & Cook, 182

C.I. Natural Yellow 13

C.I. 75640, 75430, 75650, 75670, 75690, 75700, 75695

The dried unripe berries of various shrubs of the buckthorn family, e.g. *Rhamnus amygdinus*, *R. oleoides* and *R. saxatilis* imported from Smyrna and Aleppo, the French *R. alaternus*, *R. infectorius* and *R. catharticus* L., the latter being the Purging Buckthorn indigenous to Great Britain. The colour values of the various species differ considerably. The main colouring matter is kaempferol, C.I. 75640, but quercetin, C.I. 75670, rhamnetin C.I. 75690, xanthorhamnin, C.I. 75695, kaempferol 7-methyl ether, C.I. 75650, emodin, C.I. 75430, emodin anthranol, frangulin, rhamnocarthartin and rhamnazin, C.I. 75700, are also present

The berries are extracted with boiling water and the extract evaporated under reduced pressure, the greener and rougher the berries the better the extract

Used in calico printing with tin, alum and chrome mordants for steam yellows, oranges, browns, and olives and for shading Logwood Printing Blacks. Suitable for dyed styles on printed or discharged mordants. In combination with basic dyes, for which Persian Berries act as a mordant, for bright yellows and greens. Fastness, print on cotton with chromium acetate (S.D.C. tests): light 6–7, wash test No. 1 5–4, No. 2 3–4, fastness to light and washing on alum or tin mordants is poor

Reactions (print on chrome mordant)

HCl conc.—greenish yellow, yellow soln.
HNO_3 conc.—brownish yellow gradually becoming paler, straw-coloured solution
NaOH 10%—orange, deep yellow soln.

Literature composition

Oesch and Perkin, *JCS*, **105** (1914) 1354
P & E, 206
Mayer & Cook, 190
Thorpe, **9**, 300
—application
Parnell, 34
Napier, 347
Muspratt, 579
Hummel, 366
Manual, 355
Knecht & Fothergill, 302, 470, 842

C.I. Natural Yellow 14

C.I. 75440

Add alum to a fresh aqueous extract of Persian Berries and precipitate with soda to obtain yellow to orange lakes. Unstable to heat but moderately fast to light and unaffected by sulphur dioxide or hydrogen sulphide. Formerly used in calico printing, colouring foods and as a lime-colour in distempers, wallpaper printing, etc.

Literature

Zubelen, *Bull. Soc. Ind. Mulhouse*, **84** (1919) 511

Reactions

Yellowish brown solution in alkali from which the lake is regenerated on adding aluminium sulphate. Decomposed or decolorised by mineral acids

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C.I. Natural Yellow 15

Yellow to dark orange lakes are obtained by adding stannous chloride to a fresh aqueous extract of Persian Berries and precipitating with soda. Formerly used for colouring paper, leather, soaps, oils, waxes etc., in distempers, and in calico and wallpaper printing

Reactions

Similar to those of C.I. Natural Yellow 13

C.I. Natural Yellow 16

C.I. 75490

A calcareous infusion of the shavings of the wood of *Bignonia tecoma* or Ipé-tobacco Wood and similar species, e.g. *Tecoma ipé* and *T. ochrana*, used in Brazil as a native dye for cotton

Literature

Mayer & Cook, 109

C.I. Natural Yellow 17

Green Ebony, the woods of *Excoecaria glandulosa* and *Jacaranda ovalifolia*, native to the W. Indies, were formerly used as a substitute for Old Fustic. Their colouring matters are excoecarin $C_{13}H_{12}O_5$, and jacarandin, $C_{14}H_{12}O_5$, the constitution of neither being known—*P & E*, 605

C.I. 75160

The only known natural basic dye. Occurs in the stem and roots of Barberry or Berberry, *Berberis vulgaris* L., and in many other plants, e.g. Dar or Daru Hald, *B. aristata*; Columbo root, *Cocculus palmatus*; Golden Seal, *Hydrastis canadensis* L.; Yellow Assam Wood or Woodumpar, etc.

Formerly used in Europe for dyeing wool, silk and leather from a faintly acid bath at 50–60°C or cotton mordanted with tannin and tartar emetic. Still much used in N. India. Used at times as a food dye and as a fluorochrome in microscopy

Literature

Napier, 383
Muspratt, 571
Hummel, 367

C.I. Natural Yellow 19

C.I. 75100

The flowers of *Nyctanthes arbor tristis* L. boiled with aqueous potash and lemon juice yield a bright golden yellow direct cotton dye used in the Karia district of India for topping Safflower, C.I. Natural Red 26, to produce oranges of poor fastness

Literature

Slater, 145
Mayer & Cook, 79
Phadke, 15, 35
Bhattacharya, 16

C.I. Natural Yellow 20

The leaves of *Memecylon tinctorum* Kag. grown in the Konkan, Malabar and Coromandel districts of India

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C.I. Natural Yellow 21

The leaves of *Adhatoda vasica* grown in India

Literature

Phadke, 126

C.I. Natural Yellow 22

A red resinous powder from the pods of *Flemingia congesta*, a shrub growing in the warmer parts of India and the Harrar district of Abyssinia. It contains **Flemingin,** $C_{12}H_{12}O_3$, constitution unknown, which gives a deep orange-red solution in cold alkali. Used like Kamala, C.I. Natural Orange 2, to which it bears some resemblance, for dyeing silk and to a lesser extent wool golden yellow from a boiling sodium carbonate bath, and in Arabia as a pigment and cosmetic

Literature

P & E, 602
Mayer & Cook, 258

C.I. Natural Yellow 23

C.I. 75400

The active component present in the dried roots of Chinese or Turkey Rhubarb, *Rheum palmatum* L., used in conjunction with henna for blonde hair dyes. Dyes wool yellow direct but red on a chrome mordant. The roots also contain rhein, emodin (C.I. 75440), isoemodin, etc

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C.I. Natural Yellow 24

The dried sap of *Garcinia Hanburyi* Hook F., a tree found in Siam, Cambodia and southern Cochin China. Contains 70–80% coloured resin (α-, β, and γ-garcinolic acids, $C_{23}H_{28}O_6$, $C_{25}H_{32}O_6$ and $C_{23}H_{28}O_{28}$ respectively, their constitutions being unknown, the γ-acid turns red with alkali), 17–25% gum and a little organic debris. Indian Gamboge is obtained from *G. morella* Desrouss

Used in lacquers and as an artist's water colour; the alum lake is used in artists' oil colours

Fades slowly in daylight and rapidly in direct sunlight but if the faded material is kept in the dark the colour returns to some extent

Reactions

Ammoniacal solution gives a red lake with Ba and yellow lakes with Pb, Ag and Zn

Literature

Known to the Chinese in the 12th century A.D.
Bersch, 349
Mayer & Cook, 258
Ahmed, Rigby and Taylor, *J. Chem. Soc.*, *C* (8, 1966) 772
Dyson and Rigby, *J. Chem. Soc.*. (1963) 1858
Land and Katz, *Pharm. Acta Helv.*, **24** (1949) 387

C.I. Natural Yellow 25

C.I. 75310

The powdered flowers of *Mallotus philippensis* Müll. used in India for dyeing silk with alum in the bath and cotton with alum and lime in the bath. It yields yellows to oranges

Literature

Phadke, 15, 37

C.I. Natural Yellow 26

C.I. 75130

Carotenes are widely distributed throughout the vegetable and animal kingdoms, β-carotene being the most common isomer by far

Used for colouring margarine, fats, oils, etc.

Synthetic β-carotene is now available, see C.I. 40800

Literature

Kieferle, Seuss and Kiendl., *Proc. 12th Inter. Dairy Congr.* (Stockholm), **1** (1949) 69

Judah, Burdick & Carrol, *Ind. Eng. Chem.*, **46** (1954) 2263

Baraud, *Procès-verbaux Soc. sci. phys. et nat. Bordeaux* (1956–57) 96

C.I. Natural Yellow 27

C.I. 75125, 75135

The dried florets of the marigold, *Calendula officinalis* L., indigenous to France and parts of southern Europe, contain calendulin which is used as a yellow dye for butter and cheese. Calendulin is a mixture of carotenoid pigments principally lycopene, C.I.75125, rubixanthin, C.I. 75135, and **violaxanthin,** $C_{40}H_{56}O_4$, the precise constitution of the latter being unknown. Synthetic lycopene is now available semi-commercially

Literature

Mayer & Cook, 20, 49, 58

C.I. Natural Yellow 28

C.I. 75760

Produced by pressing the fresh flowers of the Pallas tree, *Butea frondosa* Roxb., or by boiling the dried flowers in dilute lime water. Yields dyeings of poor fastness but was nevertheless much used in India for yellows to browns on cotton, silk and wool

Literature

P & E, 168

Phadke, 14

Bhattacharya, 16

NOTES

C.I. Natural Orange 1

The root bark of *Ventilago madraspatana* Gaertn., one of the *Rhamnaceae*, a climbing shrub found in Western India, Ceylon, Mysore and Burma. Appears in commerce as dark red or brown chips, shavings or fibres containing 8–10% of colouring matter. Used in parts of India as an orange mordant dye for cotton, wool and silk where fastness is of no importance. Contains several pigments the chief being ventilagin, $C_{15}H_{14}O_6$, of undetermined constitution

Reactions

Purple-red solution in alkalis. Soluble in carbon disulphide

Literature

P & E, 74
Mayer & Cook, 151
Phadke, 18

C.I. Natural Orange 2

C.I. 75310

An orange red powder present in the pods of *Mallotus Phillippiensis* Muel., a shrub found in India, Ceylon and Burma

Much used in India for producing golden yellows on silk and wool of fairly good fastness to washing but of only moderate fastness to light

Literature

Phadke, 107
Bhattacharya, 10
Shroff and Trivedi, *J. Indian Chem. Soc.*, Ind. Ed., **3** (1940) 109, 127

C.I. Natural Orange 3

C.I. 75110

Occurs in the roots and shoots of *Scrophulariaceae escobedia, scabrifolia* and *linearis* which grow in tropical America from Peru to Mexico where it is used to colour fats. Soluble in alcohol

Literature

Mayer & Cook, 86

C.I. Natural Orange 4

C.I. 75120

Cakes containing 6–12% colouring matter and not more than 5% ash are obtained by macerating the seeds and pulp of the shrub *Bixa orellana* L. with water, allowing to ferment, filtering the Annatto which separates out and drying in the sun. The shrub is cultivated in Cayenne (**Flag** or **French Annatto**—the best quality containing 10–12% dye), Brazil (**Spanish Annatto**—contains less than 6% dye), New Orleans (**Dutch Annatto**), W. Indies and India. The colouring matter present is principally bixin, C.I. 75120, but at least six others are also present one of them being probably ξ-carotene. Dyes a direct orange red to yellowish orange on wool, silk and cotton or orange, greenish yellow and lemon yellow on alum, chrome and tin mordants respectively. Fastness: light—poor; washing—good; dilute acids—good; chlorine—good; milling—good

Cotton is treated in a boiling soda ash bath for 15 minutes and then rinsed in a weak acid or alum solution: may be also used with a tin and sumach mordant or for yellows on a potassium aluminate mordant. Silk dyes golden yellow with equal parts of Annatto and soda ash from a soap bath for 1 hour at 50°C. Subsequent treatment with weak tartaric acid yields an orange red. Wool dyes at 80–100°C without addition. It is used in printing dissolved in caustic soda and developed with acid, alum or stannous chloride, for steam colours a paste of Annatto, caustic soda, tartaric acid and alum is used. Used for colouring butter, cheese, oils and soap, and in woodstains. Formerly used in varnish, its original use was as a war-paint by S. American Indians

Standard

India: IS 2557:1964 Annatto colour for foodstuffs
New Zealand: D 5147 Annatto for colouring cheese
S. Africa: SABS 519 Annatto for food products

Reactions

H_2SO_4 conc.—cornflower blue, on dilution—dark blue

Literature

Parnell, 31
Napier, 365
Muspratt, 570
Hummel, 355
Manual, 358
Bhattacharya, 15
Bühler, *Ciba Rev.*, **6** (1948) 2490
Diemar, Janecke and Heusser, *Naturwissenschaften*, **39** (1952) 211
Diemar and Heusser, *Z. Lebensm.-Untersuch. v. Forsch.*, **97** (1953) 289
Osteraas and Olsen, *Chem. and Ind.*, No.23 (1967) 952

C.I. Natural Orange 5

C.I. 75180

A direct dye for cotton and wool used by Central American Indians. Comes into commerce as red cakes containing 4% dye. Yields more brilliant dyeings than Annatto

Literature

Napier, 376
Muspratt, 575
Slater, 42

C.I. Natural Orange 6

C.I. 75480

The powdered dried leaves of the **Egyptian privet** (known in India as Mehendi) *Lawsonia alba* Lam., *L. spinosa* L. and *L. inermis* L. Main use is as a hair dye and in cosmetics but it is a direct dye for wool and silk and is still used in India and Morocco for dyeing textiles orange, either as an acid dye or on an alum mordant

Henna-reng, used in the East as a black hair dye is a mixture of powdered henna and indigo leaves

Literature

BP 236,557; 493,855
Cox, *Chem. & Ind.*, **55** (1936) 780; *Analyst*, **63** (1938) 397
Redgrove and Bari-Woolls, *Hair Dyes and Hair Dyeing*, London (1939)
Galloti, *Ciba Rev.*, **2** (1939) 751
Phadke, 17
Bhattacharya, 14

NOTES

C.I. 75100, 75670

The flowers of the Toon or Indian mahogany tree, *Cedrela toon* Rox., grown in the Himalayas, S. India, Java and Australia, are used as a red dye in India. The principal colouring matter present is nycanthin, $C_{34}H_{46}O_7$, but crocetin, C.I. 75100, and quercetin, C.I. 75670, are also present

Rice on which the fungus 'aghkak', *Monascus purpureus* Went., has been grown, used in China for colouring drinks and food. It contains two pigments soluble in ether, monascin, $C_{24}H_{36}O_6$ (deep yellow), and monascorubin, $C_{22}H_{24}O_5$ (red), their constitutions are unknown as is that of a third pigment monoascoflavine, $C_{17}H_{22}O_4$, which is also present

Reactions

Soluble in ether, H_2SO_4 conc. and NaOH. Precipitated from alkaline solution by carbon dioxide

Literature

Saloman and Karrer, *Helv. Chim. Acta*, **14** (1931), 18
Nishikawa, *J. Agric. Chem. Soc. Japan*, **8** (1932) 1007
Karrer and Geiger, *Helv. Chim. Acta*, **24** (1941) 289
Mayer & Cook, 260

C.I. 75460

One of the oldest dyes known. Formerly used similarly to cochineal and on an alum and tartar mordant for Venetian scarlets

Literature

Muspratt, 509
Napier, 390

C.I. 75470

The dried bodies of the female of the insect *Coccus cacti* L., containing approximately 10% of carminic acid. Formerly much used on tin-mordanted wool and alum- and tin-mordanted silk to produce brilliant scarlets. Applied to wool from a bath containing scarlet spirits (acid solution of stannous nitrate), tartar and cochineal (grain). Traces of copper or iron dull the dyeings. Its salts have the following colours: alum and tin—scarlet, alum—crimson, barium—dull violet, chrome—purple, copper—claret, iron—purple, lead—brownish red, magnesium—pink, mercury—scarlet, tin—scarlet, uranium—green, zinc—crimson. It was seldom dyed on cotton but was used in printing as an albumin colour for pinks. Fastness to light is good but that to washing is poor the dyeings becoming duller and bluer. Used as a food dye. Used as an indicator when titrating ammonia as it is almost unaffected by carbon dioxide and the colour change (alkali—purple, acid—yellow, pH range 5–6) is well defined in artificial light. Carminic acid and its ammonium and aluminium salts are used as biological stains

Silver Cochineal is obtained when the insects are killed by dry heat

Reactions

	Alum mordant	Tin mordant
H_2SO_4	scarlet	dark violet
HCl	scarlet	orange red
HNO_3	yellow	yellow
$SnCl_2$(acid)	orange red	orange
NaOH	reddish violet	reddish violet

Literature

Parnell, 32
Napier, 384
Muspratt, 575
Hummel, 348
Manual, 365
Isles, *JSDC Jubilee Issue* (1934) 134
Stansfield, *ibid.*, 139
Rothemann, *Seife-Öle-Fette-Wachse*, **75** (1949) 542
Remington & Francis, *Pigments*, 3rd Ed. London (1954) 199

C.I. 75470 salts

Lakes of cochineal formed on starch, alumina or blanc fixe. They have poor fastness to light and weather but they are transparent and are used as artists water colours, for colouring confectionery and cosmetics and occasionally in printing ink

Cochineal digested with ammonia to which gelatinous alumina has been added and the product dried. Dyes bluer than cochineal. Formerly used to a small extent to blue bleached cotton

C.I. Natural Red 5

Powdered Hirda, *Terminalia chebula* Retz., or Bahera, *T. belirica* Roxb., is extracted with cold water and the extract used in India with an alum mordant to produce reds particularly in calico printing. Because of its high tannin content it is also used with iron for blacks (see C.I. Natural Brown 6) and also for galling for Turkey Reds, etc.

Literature
Phadke, 17

C.I. Natural Red 6

C.I. 75330

The root of *Oldenlandia umbellata* L. or *Hedyotis umbellata* L. found in sandy soils in India, Ceylon and Burma. Yields brighter dyeings than Madder, C.I. Natural Red 8, but has the same general properties

Literature
Bhattacharya, 4

C.I. Natural Red 7

The lakes of various Soluble Redwoods (C.I. Natural Red 24), alone or in conjunction with the lakes of Quercitron Bark (C.I. Natural Yellow 10), Persian Berries (C.I. Natural Yellow 13) or Old Fustic (C.I. Natural Yellow 11). They vary in hue from bright crimson to deep cherry red and in some cases are brownish-orange red, yellowish-pink or deep purple red. Arsenic acid may be present as a brightening agent
Garnet Lake is the tin-chrome or tin-alum-chrome salt of **St. Martha Wood**
Dahlia or **Maroon Lake** is the tin-alum-chrome-calcium salt of **Pernambuco Wood**
Purple Lake is the tin-chrome salt of **Soluble Redwood** co-precipitated with the tin-alum salt of **Persian Berries, Quercitron Bark, Flavine** or **Young Fustic**
Cochineal Red is the tin-chrome salt of **Soluble Redwood** and **Persian Berries**
Rose Pink is **Brazil Wood** lake precipitated on whiting

They are unstable to heat and light and are partly decolorised by sulphur dioxide. Behaviour to hydrogen sulphide varies some being unaffected whereas others are darkened. Formerly used for wallpaper and coloured paper, paints and lacquers, distempers, lime washes, etc.

Reactions
Incompletely soluble in alkali to a brownish-red solution, a faintly reddish yellow precipitate forming on addition of mineral acid. Decomposed by mineral acid with formation of a turbid yellow to orange-red solution

Literature
Bersch, 383
Boyd and Robertson, *JCS*, (1948) 174

C.I. Natural Red 8

C.I. 75330, 75340, 75350, 75370, 75410, 75420

The ground root of the madder plant, *Rubia tinctorum* L., formerly cultivated in many parts of Europe and N. and S. America. Was largely used for dyeing Turkey Reds on cotton mordanted with alum in presence of lime. Applied to wool on an alum- or chrome-cream of tartar mordant. Can be dyed in a single bath with the help of a little sulphuric acid but the dyeings are not as fast as those produced on a mordant. Use of hard water or addition of lime to madder dyebaths is essential. It was used on silk mordanted with basic aluminium sulphate for pinks and reds of excellent fastness to light and degumming. Once a most important dye in calico printing for reds, pinks and chocolates. Madder gave dyeings of good fastness to light and washing on all mordants, yielding scarlet on alum, claret on chrome, yellowish brown on copper, violet on iron and pink on tin

It had extensive use in lake making and was a permitted dye for foodstuffs in some countries. Used as a ferment in indigo woad vats
Wild Madder, the root of the wild variety of *R. tinctorum*, has properties and uses very similar to those of the cultivated variety

Reactions
H_2SO_4 conc.—deep yellow red, on dilution—orange red ppt.
NaOH conc.—violet

Literature (Composition)
P & E, 23
Ciba Rev., **4** (1941) 1398
Mayer & Cook, 119
Thorpe, **7**, 455

Literature (Application)
Parnell, 36
Napier, 353
Muspratt, 603, 668
Hummel, 344, 426
Manual, 362
Knecht & Fothergill, 449
Phadke,
Hummel, *JSDC*, **1** (1885) 11
Schaeffer, *Ciba Rev.*, **4** (1941) 1407
Haller, *ibid.*, 1417
Bühler, *ibid*, 1423
Rothemann, *Seife-Öle-Fette-Wachse*, **75** (1949) 542

C.I. 75330, 75420

Madder lakes vary in hue from bluish to yellowish reds and were once largely used in oil paints and printing inks but most madder lakes of commerce are now made from synthetic alizarin. They are unaffected by 5% HCl or 5% Na_2CO_3 but are turned towards violet by strong alkali. Insoluble in water, common solvents, oils and waxes and non-bleeding towards soap gel. Madder lakes lack hiding power and paints containing them should always be used with an undercoat. All the madder lakes have very good fastness to light but because they contain purpurincarboxylic acid have a slightly lower fastness than the lakes made from synthetic alizarin. Darken only slightly on heating in lithographic varnish at 300°F for 30 minutes. Also used in cosmetics, tooth pastes, glazing colours, crayons and artists' colours

Madder Lake was produced by boiling Garancine, C.I. Natural Red 10, with dilute alum, filtering hot, cooling the filtrate, separating the precipitate which settled out, redissolving in ammonia and finally precipitating with alum and/or stannous chloride

Pink Madder was the alum lake of **Kopp's Purpurin** (the precipitate obtained when madder is extracted with cold dil. nitric acid and the extract heated to 60°C). Used to a limited extent as an artist's pigment

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C.I. Natural Red 10

C.I. 75330

Charbon sulphurique or **Garancine** was made by heating Madder with dilute sulphuric acid and then with concentrated sulphuric acid. It was used for dyeing the reds for French army uniforms, use of synthetic Alizarin being forbidden

Garanceux or **Spent Garancine** was similarly prepared from spent Madder from dyebaths and was a low quality Garancine

Literature
P & E, 32

C.I. Natural Red 11

C.I. 75330

The product obtained by heating Garancine, C.I. Natural Red 10, with steam at 150°C.

Literature
P & E, 33

C.I. Natural Red 12

C.I. 75330

A fermentation product obtained by steeping madder in cold water slightly acidified with sulphuric acid

Literature
P & E, 33

C.I. Natural Red 13

The root of *Asperula tinctoria* L. formerly used as a madder substitute. Other species of *Asperula* were similarly used

Literature
Bancroft, 307

C.I. Natural Red 14

C.I. 75420

The roots of various species of *Galium* have been used at times for dyeing reds on alum mordants. The dyeings resemble those of madder both in appearance and properties

Literature
P & E, 40

C.I. Natural Red 15

Ground madder is extracted with cold aqueous sulfurous acid, 2–3% of hydrochloric acid (33%) is added to the extract which is then boiled for 2 hours. The **Commercial Purpurin** which settles out is removed and the extract boiled for another 2 hours when a deep green precipitate forms which was once a commercial article under the name of Green Alizarin

Literature
P & E, 29
Thorpe, 7, 437

C.I. Natural Red 16

C.I. 75340, 75350, 75370, 75410

Munjeet or the **Indian Madder** of some authors is the root of *Rubia cordifolia* L. or *munjista* and yields brilliant reds when used instead of madder. Similar hues are given by *R. khasiana* which yields somewhat deeper dyeings and *R. sikkinensis* Kurz. which has only half the colour value of Munjeet. Moderately fast to light, washing and soda boiling on cotton, silk and wool

Literature
Napier, 365
Muspratt, 621
P & E, 41
Phadke, 121
Bhattacharya, 3

C.I. Natural Red 17

The flowers of the tree *Woodfordia floribunda* (Dharri) or *Grislea tomentosa* Rox. (Dhayati). Used throughout India in conjunction with Morinda Root, C.I. Natural Red 18, and alum, and also with alizarin 0·5–1·5 parts of dharri flowers being used to 1 part of alizarin. In addition to the dye the flowers contain 20% by weight of tannin

Literature
Phadke, 15, 128

C.I. Natural Red 18

C.I. 75380, 75390

Al and **Morinda** are the root of *Morinda citrifolia* L., **Suranji** is the root of *Calysaecion longifolion*, both of which are cultivated in parts of India. They yield brighter dyeings than madder and the dyebath does not require boiling as they dye in the cold. Moderately fast to light, washing and soda boiling in cotton, silk and wool

Literature
Napier, 372
Muspratt, 627
Slater, 190
Phadke, 14, 16
Bhattacharya, 5

C.I. Natural Red 19

C.I. 75360, 75430

The root bark of the shrub *Morinda umbellata* L., largely used in Java for fast reds in batik printing. Also found in Ceylon and parts of India where it is probably regarded as a variety of Al, C.I. Natural Red 18

Literature
P & E, 48

C.I. Natural Red 20

C.I. 75520, 75530

The root of *Anchusa tinctoria* L. A variety formerly used came from the roots of *Lawsonia inermis* L. (the leaves of which are a source of henna, C.I. Natural Orange 6)

Alcoholic solutions are used for colouring artificial wines. Because of its solubility in hydrocarbons used for colouring cosmetics. Also used for colouring confectionery and sweets and as a biological stain

Formerly used as a mordant dye (violet on alum) especially in calico printing

Literature
Napier, 369
Muspratt, 569
Slater, 12

C.I. Natural Red 21

The bark of *Elaedendron glaucum* Dalz, grown in the Western Ghauts, India. Used for dyeing clothes ochre red

Literature
Phadke, 126

C.I. 75510, 75540, 75550, 75560

Barwood is the wood of *Baphia nitida* of the W. African coast. In addition to the above it also contains four colouring matters—baphiin, $C_{24}H_{20}O_8$, baphic acid, $C_{24}H_{22}O_{10}$, baphinitin, $C_{24}H_{24}O_6$ and baphinitone, $C_{26}H_{26}O_6$, the constitution of all being unknown

Camwood is the wood of a similar tree, it contains Santalin, C.I. 75540 and Santarubin, $C_{27}H_{14}O_5(OCH_3)_4$, whose constitution is unknown

Sanderswood is the wood of the trees *Pterocarpus sanalinus* L. and *P. indicus* of the E. Indies, Ceylon, etc. They dye both mordanted and unmordanted wool and mordanted cotton. Sanderswood gives the yellowest and Camwood the bluest and brightest dyeings, they give respectively dyed direct, brick red and violet red, and on alum, orange red and red, on chrome, brownish red and reddish violet, copper, brown in both cases, iron, maroon and violet, and tin, red and bluish red. Barwood was similar to Camwood but somewhat duller, both were faster than Peachwood, C.I. Natural Red 24, for which they were both frequently used as a substitute by 1850. Fastness: acid—moderate, alkali—poor, light—poor, milling—good. Barwood is only used now in the U.K. for dyeing chrome leather. Properties on chrome tannage (S.D.C.) Light 6, Penetration 3. In the U.S.A. Camwood is still used to a limited extent for dyeing wool and cotton compound shades and for bottoming indigo; also for lakes for wallpaper printing; narrow sticks of Camwood are used for marking stone and cement. Insoluble redwoods are permitted food dyes in some countries

Narrawood contains as its main colouring matter narrin, constitution unknown, whose dyeing properties are similar to those of santalin, C.I.75540

Literature (Composition)

P & E, 586
Thorpe, **1**, 650
Roberts & Whalley, *JCS*, (1954) 2794

Literature (Application)

Parnell, 32
Napier, 335
Muspratt, 572
Hummel, 340
Manual, 360
P & E, 580
Isles, *JSDC Jubilee Issue*, (1934) 134
Stansfield, *ibid.*, 139

C.I. 75510

Wood of *Adananthera payonia* W. found in India and Peru. Used in India mainly for woodstaining but also to a small degree (much less than true Sanderswood, C.I. Natural Red 22) for dyeing textiles

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C.I. 75280

The wood of various species of *Caesalpina* trees

Pernambuco Wood, *C. crista* L., from Jamaica and Brazil gives best colour value

Brazil Wood, *C. braziliensis* L., from Brazil has only half the colour value of Pernambuco Wood

Sappan and **Lima Wood** are *C. sappan* L. from E. Asia and the Philippines respectively

Peach Wood, *C. echinata* L., from Central and S. America

Brazil Wood extract, Brasilin or **Brazilin,** is obtained by boiling the rasped wood with water, filtering and concentrating under vacuum

The soluble redwoods dye chromed wool bordeaux to dull reddish violet depending on the method of mordanting and alum mordanted wool bluish red, both of poor fastness to light and washing and destroyed by acids and alkalis. With copper, drabs to claret browns are obtained, with iron, violet green to claret and with tin, scarlets. Formerly widely used on wool as a shading colour for browns with other dyewoods on chrome mordants; on cotton for reds with alum, scarlets on mixed alum and tin mordants in conjunction with fustic and with logwood on iron for dull purples; on silk for crimsons on alum or tin; for printing dull purples on iron-alum mordanted cotton and as a substitute for alizarin in cheap dyed styles. In the U.S.A. still used to a limited extent for cotton and wool dyeing and for producing a dark maroon on chromed nylon, also in calico printing with aluminium acetate or stannic oxalate (Sappan Wood extract). Used on chrome and vegetable tanned leather mainly as a ground for topping with synthetic dyes. Brazilin is also used as a biological stain. In conjunction with Carmine, C.I. Natural Red 4, used for making **Florentine Lake,** cf. C.I. Natural Red 7, a valuable pigment for face creams and lipsticks

Gulal a red starch much used in India, was coloured with Sappan Wood extract

Reactions (on chromed wool)

H_2SO_4 conc.—dull yellow, solution yellow with greenish fluorescence

NaOH 10%—slowly decolorised, solution pale pink becoming brownish

Literature

Parnell, 32
Napier, 331
Slater, 38
Hummel, 338
Manual, 359
Bhattacharya, 13
Knecht & Fothergill, 304
Stansfield, *JSDC Jubilee Issue*, (1934) 139
Rothemann, *Seife-Öle-Fette-Wachse*, **75** (1949) 542
Arshid, *et al.*, *JSDC*, **70** (1954) 402

C.I. Natural Red 25

C.I. 75450

The solidified exudation of the insect *Coccus laccae* which lives on various trees in the E. Indies, Ceylon and Canary Isles. Formerly used as a red mordant dye on wool. It contains approximately 50% of laccaic acids which are extracted by dilute aqueous sodium carbonate. Its dyeing properties are very similar to those of cochineal but its dyeings have better fastness

Literature

Parnell, 35
Napier, 389
Muspratt, 600
Hummel, 354
Daruwalla *et al.*, *J. Sci. Ind. Research* (India), **20D** (1961) 22
Katagiri, Mugibayashi and Morihara, *Bull. Inst. Chem. Res., Kyoto Univ.*, **18** (1949) 41
Katagiri, Mugibayashi and Omori, *ibid.*, **20** (1950) 67
Kamath and Potnis, *Paintindia*, **3** (1) (1953) 107
Lindsay & Harlow, *Report on Lac and Shellac*, Indian Forest *Records*, **8** (Part I) (1921) 66

C.I. Natural Red 26

C.I. 75140

The dried petals (Safflower, etc.) or their soda extract (Safflower Carmine, etc.), of the Dyer's Thistle, *Carthamus tinctorius* L., cultivated in China, India, Persia, Egypt, S. and Central America, and S. Europe. The dried petals contain up to 36% of Safflower Yellow, C.I. Natural Yellow 5, which has no dyeing properties, and about 0·5% of Safflower Carmine, which is one of the oldest dyes known. Dyes silk and cotton from an alkaline bath which is gradually neutralised with citric acid to produce beautiful reds and pinks of poor fastness to light and washing. Formerly used for Government red tape and is still much used in the East as a textile dye. Used for dyeing artificial flowers, food and cosmetics and in the manufacture of pigments

Reactions

H_2SO_4—dull red

Literature

Napier, 347
Muspratt, 624
Hummel, 356
Manual, 358
P & E, 594
Mayer & Cook, 208
Phadke, 33, 35
Bühler, *Ciba Rev.*, **6** (1948) 2489

C.I. Natural Red 27

The aqueous extract of the bark of the Kasila tree provides a mordant dye yielding a red somewhat like that of Kasumba (C.I. Natural Red 26)

Used in parts of India to top indigo to produce purples and violets

Literature

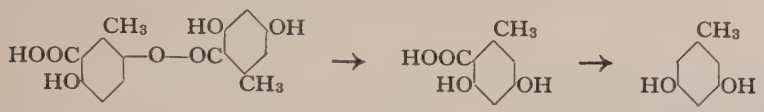
Phadke, 25

NOTES

Orchil is obtained from **Orchella Weed** (various species of *Roccella* lichens) found in the Azores, Canary Islands and the Cape of Good Hope or from **Orchella Moss** a lichen found in the Cape Verde Islands

Cudbear was originally obtained from lichens (*Lecanora*) found in Scotland but later the name was also applied to the product obtained from lichens from other sources

The lichens contain colourless acids, e.g. lecanoric acid, converted through orcellinic acid into orcinol



which is converted by air oxidation in presence of ammonia into **Orcein,** whose alkali salts are purple (Orchil); if potassium or sodium carbonate is also present the reaction proceeds further and finally yields the blue, alkali salts of **Litmus.** Orcein seems to be a mixture of red orcein, $C_{28}H_{24}N_2O_7$, a yellow compound, $C_{21}H_{29}NO_5$ and an amorphous product similar to litmus. Litmus contains **Azolitmin,** $C_9H_{10}O_5$ or $C_7H_7NO_4$, erythrolitmin, $C_{13}H_{22}O_6$, and other compounds

French Purple was the calcium lake of orcein used in cotton dyeing and as an albumen colour in calico printing. Orchil dyes wool from a neutral, acid or slightly alkaline bath, with or without a mordant (direct—bluish red, alum—bluish red, copper—dull purple, iron—brownish violet, magnesium—bright reddish violet, zinc—violet). Dyes slowly and evenly. Chiefly used to give a violet or purple bloom by topping other dyeings or bottoming wool before applying Indigo from a wood vat. Use as a food dye, either dissolved in alcohol or sulphurated, permitted in some countries. Used for dyeing leather in conjunction with Insoluble Redwoods. For colouring soaps, wines and pharmaceutical products

Litmus extensively used as an indicator, **Lacmus** is a chemically pure form

Tournesole en drapeaux made at Grand-Gallargues, Gard, France. Coarse linen cloth is soaked in the deep bluish-green sap expressed from the berries and tops of *Croton tinctorium,* dried quickly in the open air and exposed for 60–90 minutes between layers of straw to the ammoniacal vapours of lant or horse dung. The cloth turns deep blue. The process is repeated until the cloth becomes purple or dull green. Such impregnated cloth was used by Dutch farmers to make a blue infusion to dye their cheeses red, the change from blue to red being caused by the lactic and butyric acids in the cheese (Joly, *Ann. Chem. Phys.*, **6** (3) (1842), 111). The blue colour is not restored by alkali and so the dye is quite distinct from litmus

Tournesole en pain made chiefly in Holland as small pale blue cubes composed of gypsum and chalk with but little colouring matter mostly present as a lake

Himalayan Lichen much used in Upper India to dye silk fugitive reds

Azolitmin is used as an indicator and as a biological stain

Orcein (synthetic) is used as a microscopic stain

Reactions

Orcein *in substance*

Na_2CO_3 0·5%—violet

H_2SO_4 5%—orange solution, made alkaline-violet

Often adulterated with Magenta for estimation see *Manual*, 837

Orcein *on fibre*

H_2SO_4—fibre and solution purple, on dilution—solution red, fibre colourless

HCl—fibre and solution red

NaOH—fibre and solution bluish purple

HNO_3—fibre yellow

$SnCl_2$(acid)—decolourised

Distinguished from Magenta by not being decolourised by HCl or NaOH

Literature (Constitution)

Bedford, *BP* 6777 (1889), 6778 (1889); *GP* 57612 (1889)

Gordon, *Memorial of Mr. Cuthbert Gordon, Relative to the Discovery and Use of Cudbear and other Dyeing Wares*, n.p., n.d. (*c.*1785)

Magner, *J. Pharm. Chim.*, **12** (1826) 418

Desposses, *ibid.*, **14** (1828) 487

Peretti, *ibid.*, 539

Robiquet, *Ann. Chim. Phys.*, **47** (2) (1831) 6, 238

Laurent and Gerhardt, *ibid.*, **24** (3) (1848) 315

Thillaye, *Pol. Centr.*, (1854) 493

Chandois and Martin, *ibid.*, 1326

Crookes, 374

Liebermann, *Ber.*, **7** (1874) 247, 1100; **8** (1875) 1649

Weselsky, *Ber.*, **7** (1874) 439

Haas, *Z. anal Chem.*, **20** (1881) 369

Krämer, *Ber.*, **17** (1884), 1879

Zulkowsky and Peters, *Monatsh.*, **11** (1890) 227

Nietzki and Maeckler, *Ber.*, **23** (1890) 718

Zopf, *Die Flechtenstoffe*, Jena (1907)

Floutier, *Dyer* (1921), 226

P & E, 556

Asahina, *Acta Phyto Chim.*, **8** (1934) 33

Musso, *Chem. Ber.*, **96** (1963) 1936

Literature (Application)

Gordon, *above*

Napier, 370

Muspratt, 570

Slater, 22 (Archil), 67 (Cudbear), 98 (French Purple), 151 (Orchella Weeds)

Crookes, 374

Hummel, 355

Manual, 364

Floutier, *Dyer* (1921) 226

Isles, *JSDC Jubilee Issue*, (1934) 134

Stansfield, *ibid.*, 139

Bolton, *Lichens for Vegetable Dyeing*, London (Studio) 1960

C.I. Natural Red 29

The flower buds of *Calysaccion longifolium* W. grown in the Goa and S. Konkan districts of India. Used in S. India for dyeing fast dark reds or yellows. The colouring matter calycian, $C_{18}H_{12}O_5$, is of unknown constitution

Literature

Phadke, 124

C.I. Natural Red 30

The bark of *Soymida febrifuga* Juss. grown in the Deccan and Orissa, India, and used to produce dark red dyes

Literature
Phadke, 126

C.I. Natural Red 31

C.I. 75200, 75210

The resinous secretion found in the fruits of *Doemonorops propinqus* and similar species found in Sumatra and Borneo. Used for colouring lacquers and varnishes and in the printing trade for preparing half-tone plates for multi-colour printing

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C.I. Natural Red 32

The pale red powder obtained from the sheaths of the Great Millet grass, *Andropogon sorghium*, var. *vulgaris* (*Sorghium vulgare*), contains durasantalin, $C_{48}H_{39}O_{15}$, of unknown constitution, whose violet-red alkaline solution becomes brown by atmospheric oxidation. Used in Egypt as a direct dye for dull reds on wool and on mordanted wool for very fast and slighter fuller dyeings: in the Sudan used for staining grass for mats and for dyeing leather

Literature
P & E, 593
Mayer & Cook, 150
Cross, *Thorpe*, **10**, 478

NOTES

C.I. 75780, 75790

Natural Indigo obtained by fermenting the leaves of various species of *Indigofera*, running off the liquor and oxidising it to precipitate the dye
Wild Indigo root, *Baptista tinctoria* R. Br., formerly used as an inferior substitute for Indigo
Gara the powdered dry leaves of *Lonchocarpus cyanescens* contains *c.* 0·6% indigotin. Extensively used in W. Africa and the W. Sudan
Woad obtained from *Isatis tinctoria* L.
Kalkudai or **Pala Indigo** obtained from *Wrightia tinctoria* R. Br. and used in S. India
Natural Indigo obtained from *I. sumatrana* (**Bengal Indigo**) contains Indigotin, C.I. 75780, Indirubin, C.I. 75790, Indigo Brown (brown amorphous substances with little if any affinity for the fibre), **Indigo Gluten, Kaempferol** or **Indigo Yellow,** C.I. 75640, when derived from *I. arrecta* (Natal Indigo)
Natural Indigo is applied similarly to the synthetic variety, C.I. Vat Blue 1, *q.v.*, but is claimed to possess greater affinity for the fibre and somewhat better fastness

Literature

Parnell, 35
Napier, 270
Muspratt, 366, 584, 633
Hummel, 295
Phadke, 26
Haller, *Ciba Rev.*, **8** (1951) 3072, 3077, 3083
Bühler, *ibid.*, 3088
Vetterli, *ibid.*, 3066
Bibliography of the History of the Production and Application of Indigo, *ibid.*, 3091
Hurry, *The Woad Plant and its Dye*, London (1930)

C.I. 75781

Sulphonated natural indigo was extensively used in the 19th century but has been almost entirely replaced by the synthetic product except in those countries, e.g. India, where some natural indigo is still produced. Its properties and application were almost identical with those of the synthetic product for which see C.I. Acid Blue 74
Intense Blue an artists' water-colour pigment prepared from Indigo Extract

Literature

Hummel, 317
Phadke, 46

C.I. 75190

The flowers of the Japanese 'Tsuykusa', *Commelina communis* var. *hortensis* Makino, used for making awobana paper. In addition to the main pigment there is also present a pale yellow pigment, awobanol, of unknown constitution. Formerly used in Japan for dyeing silk

Literature

Kuroda, *Proc. Imp. Acad. Tokyo*, **7** (1931) 61; **9** (1933) 64
Mayer & Cook, 228

NOTES

C.I. Natural Green 1

Occurs in species of *Rhamnus* of which two in particular *R. chlorophorus* Dec. and *R. utilis* Dec., Hong pi lo chou and Pé pi lo chou, are found and utilised in China. The bark of the twigs is boiled in water and cotton cloth immersed in the colourless liquor. The cotton absorbs a substance from the liquor which oxidises in air to green. This is repeated 20–30 times and the dye then removed from the cotton and used for dyeing cotton and silk. The colouring matter **Lokao,** $C_{42}H_{28}O_{27}$, present in the plant as a glycoside, is of unknown constitution. On silk it is of excellent fastness to light and is also fast to acids and alkalis; it is best applied from an alum bath containing calcium salts. It dyes cotton green from a weakly alkaline bath, best results being obtained by use of a soap bath. Reduced with faintly acid or alkaline stannous chloride it can be used as a vat dye to yield blue dyeings

Reactions

H_2SO_4 conc.—brownish red solution
Alkali—green solution gradually turning brown

Literature

Rondot, *Notice du vert de Chine*, Paris (1858)
Crookes, 429
Cloëz and Guignet, *Ber.*, **5** (1875) 388
Kayser, *Ber.*, **18** (1885) 3417
Rupe, *Die Chemie der natürlichen Farbstoffe*, Brunswick (1900) p.276
Bersch, 411
Mayer, 254
FDX 893 frames 1101–4

C.I. Natural Green 2

C.I. 75440, 75650, 75695

Produced by crushing the almost ripe berries of *Rhamnus cathartica* L. or similar species of buckthorn, fermenting for 10 days, pressing them and treating the extracted juice with alum and potash, evaporating the mixture to a thick syrup and then packing in bladders (*Bersch*, 410). A similar product was obtained by mixing the juice of the ripe berries with lime and evaporating to dryness (*P & E*, 210)

Formerly used for colouring paper and leather and to some extent in artists' water colours

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C.I. Natural Green 3

C.I. 75810

Chlorophyll is mainly used for colouring soap green or greenish yellow as it is oil soluble and unaffected by alkalis. Also used for colouring oils, perfumes and foodstuffs

Literature

Judah, Burdick & Carroll, *Ind. Eng. Chem.*, **46** (1954) 2262

C.I. Natural Green 4

Powdered *Pistachia integerrima* Stewart used in parts of India to produce greens on alum-iron mordanted cotton

Literature

Phadke, 30

C.I. Natural Green 5

C.I. 75815

Potassium (or sodium)-copper,-iron, or-magnesium salts of chlorophyllin are sold commercially as water-soluble chlorophyll

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C.I. 75620

The wood of the stem and larger branches of the Venetian Sumach, *Rhus cotinus* L., a shrub found in S. and E. Europe, the Levant, Jamaica, etc. Dyed on mordanted wool (alum—orange, chrome—reddish brown, iron—brownish olive, tin—reddish yellow) it has poor fastness to light and wet treatments. Formerly used in the U.K. for red browns on chrome and oranges on tin mordants and for scarlets with cochineal. Formerly used in combination with Peachwood, C.I. Natural Red 24, and Logwood, C.I. Natural Black 1, to dye alum-mordanted silk brown. Limited use for fawns and beiges on light leather

Cotinin was an extract made by the process described by Nowak and Benda, *GP* 2552

Literature

Napier, 341
Muspratt, 579
Hummel, 364
Manual, 356
Ferro, *Cuioio Pelli Mat. concienti*, **28** (1952) 359
Parsy, *Teintex*, **20** (1955) 957

C.I. Natural Brown 2

Obtained by nitration of the White Mangrove, *Laguncularia racemosa* Gaertn., and similar trees of the *Combretaceae* family. This family also contains the *Terminalia*, some species of which provide myrobalans (*Brazilian P.* 8942 and 9159, see also C.I. Natural Brown 6). Used in Brazil for dyeing cotton and aftertreating with copper sulphate and chrome to yield khaki browns of very good fastness to light and washing

Reactions

Water—brown solution
HCl 20° Be.—olive solution, brown precipitate
NaOH 38° Be.—dark brown solution

C.I. Natural Brown 3

C.I. 75250

The extracts of various vegetable matters containing large amounts of tanning materials derived from catechins or related substances

Bengal Cutch is obtained from the red heartwood of a tree, *Acacia catechu* Wild., found in India and Burma and from the betel nut, *Areca catechu* L.

Kath is a crystalline product obtained by suspending twigs in a hot concentrated solution of Bengal Cutch

Gambier is obtained from the leaves and twigs of a bush, *Uncaria gambir* Roxb., cultivated in Malacca, Penang and Singapore

Patent or **Prepared Cutch** is produced by melting Gambier with *ca.* 1% potassium dichromate, preferably in presence of copper sulphate, and pouring into wooden frames to solidify. It yields much redder dyeings than Gambier

New Catechu is a European extract of coniferous trees and contains tannin

Khair is obtained from *Arabica catechu* and is used in India for direct browns on silk

Babul Leaves come from the Babul tree, *Acacia arabica* Willd., and are used in India on an iron mordant

Mao or **Mao Nutgaio** is the berry or gall of *Citrus vulgaris*, used in India in the same way as Cutch

Used in cotton dyeing for browns, applied from a hot bath, usually with copper sulphate, followed by chroming. Frequently used because of its rotproofing properties. **Gambier** is used for fast browns on silk and with logwood to yield blacks of good weight. **Cutch** is also used on silk but is inferior to Gambier in colour value and weighting properties. Fastness (Cutch-medium brown with copper sulphate on cotton) (S.D.C. tests): soda boil 3–4, 4; chlorine 1–2, 5; acid spotting – H_2SO_4 2 (yellow); acetic 4 (sl. yellow); alkali spotting 3–4 (redder); light 5–6. Also used as a food and hair dye. **Gambier** and **Cutch** are used for tanning leather and for rotproofing fishing nets, tent cloths, paper makers' felts, etc.

At one time, *ca.* 1890, Catechu was extensively used on cotton for fawns, browns and blacks. For blacks the cotton was first dyed with indigo (ferrous sulphate vat) and then topped with Catechu and chrome. It was the only fast black then available. Fast greys were produced in the same way

Reactions

H_2SO_4 conc.—fibre yellower, solution pale yellow to orange

Literature

P & E, 463, 472
Parnell, 32
Napier, 263
Muspratt, 574
Knecht & Fothergill, 305, 465, 841
Phadke, 22, 23
Hummel, 368
Thorpe, **11**, 390
Bhattacharya, 9, 19
Manual, 341, 368
Rhamchandra and Venkataraman, *JSDC*, **54** (1938) 513; *Indian P.* 24,056
Pezzo, *Cuoio, pelli mat. concienti*, **31** (1955) 71
Parsy, *Teintex*, **20** (1955) 957

C.I. Natural Brown 3:1

Mangrove Cutch now almost solely used for tanning leather

C.I. Natural Brown 3:2

Goran, the bark of an Indian shrub, *Ceriops roxburghiana* Arn., has properties similar to those of Mangrove Cutch

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C.I. Natural Brown 3:3

Babul Bark, the bark of the Babul tree, *Acacia arabica* Willd., is used in India on an iron mordant

C.I. Natural Brown 3:4

Babul Pods, the seed pods of the Babul tree are distinctly different in chemical composition from Babul bark but are also used in India on an iron mordant

C.I. Natural Brown 4

Obtained from the wood of the carob tree, *Ceratonia siliqua* L. found in the Argentine. It yields light brown direct dyeings on cotton but more varied hues can be obtained by use of mordants. It acts as a mordant for basic dyes and so seems to be a tannin as its name suggest, cf. Algarobilla, C.I. Natural Brown 6

Literature
P & E, 616

C.I. Natural Brown 5

C.I. 75130, 75750

The flowers of the Indian cotton plant, *Gossypium herbaceum* L., used together with turmeric and pomegranate rind in parts of India to dye iron-mordanted cloth orange-brown to deep olive

Literature
Phadke, 23

C.I. Natural Brown 6

Obtained from a large variety of vegetable products having a high content of hydrolysable tannin
Algarobilla is the pods of the *Caesalpina brevifolia* of Chile. Tannin appears to be principally ellagitannin. One of the strongest tannin materials known containing on average 45%. It also contains 1·5% brevilagin I and 0·5% brevilagin II. Very suitable for both dyeing and tanning. Resembles divi-divi, the extract being liable to ferment
Amlaki, the fruit of the tree *Phyllanthus emblica* found throughout India and Burma. The fruit, bark and leaves of this tree are used for dyeing greys
Bahera, the fruit of the Indian tree *Terminalia bellirica* Roxb., also found in Ceylon and Burma. Used in India for inks and for dyeing cotton in the same way as Myrobalans (see also C.I. Natural Red 5)
Bakul, the bark of *Mimusops elengi* L., found in Bengal
Divi-divi or **Libi Davi** is the pods of *C. coriaria* Willd., a W. Indian and Central American shrub. Contains 40–45% tannin, mainly ellagitannin and free ellagic acid, some combined gallic acid is also present. It contains about 5% chebulagic acid and 2·5% corilagin. Used similarly to galls and sumach and in dyeing blacks but to a less extent than myrobalans
Gab, the immature fruit of the tree *Diospyros embryopteris*, found in India and Burma
Galls (Aleppo, Smyrna, E. Indian, etc.) formerly much used with iron as a base for a range of greys extending from silver grey to blue black, these greys serving as the blue element in all the tertiary colours of those days. Pyrolignite of iron was used in preference to the sulphate as the acetic acid liberated did not retard the fixation of the iron tannate to the same extent as sulphuric acid
Myrobalans, the ripe fruit of *Terminalia chebula* Retz., a tree found throughout India and Burma (see also C.I. Natural Red 5). It contains about 3% 1,2,3,4,6-pentagalloyl-β-D-glucose, 1% terchesin, 5% 1,3,6-trigalloyl-β-D-glucose, 1% corilagin, 12% chebulinic acid and 2% chebulagic acid.
Sumach from the heartwood of the tree *Rhus cotinus* L. which, like *Quebracho colorado*, contains fisetin, C.I. 75620, in addition to tannin. Used like galls, Valonia, etc. to produce slates and blacks by applying the sumach and then treating with copperas, logwood being often added to the iron liquor. Sumach was often used for browns
Tamarisk Galls from various species of tamarisk grown in Arabia and Sind are much used in India on cotton and silk
Tanner's Sumach is the leaves of *Rhus coriaria* L.
Tari, the pods of *C. digyna* or of *C. sappan* L., found in India and Burma. It closely resembles **Divi-divi** but has the advantage that its aqueous extracts do not so readily begin to ferment
Valonia contains tannins derived from valonic acid
White Sumach is obtained from the American *R. glabra* L.
Tannin-containing materials are used with iron and/or copper salts as hair dyes; those containing both gallotannin and gallic acid are used for iron tannate inks

Literature
Parnell, 37
Napier, 248 (Galls), 258 (Sumach), 267 (Valonia Nuts), 268 (Myrabolans)
Muspratt, 580, 629
Phadke, 23, 128
Thorpe, **11,** 390
Bhattacharya, 17, 18, 19
Bhattacharya, Pal & Das, *Dyeing of Khaki on cotton, Govt. Bengal Dept. Industries Bull.*, 94 (1944)
Pezzo, *Cuoio, pelli mat. concianti*, **31** (1955) 71
Slater, 70 (Divi-Divi), 134 (Myrabolans)
Schmidt, *Leder*, **14** (1963) 40 (Myrabolans)

C.I. 75500

Aqueous extract of walnut shells used as a hair dye. Formerly used in France as a direct dye for fast browns and fawns on wool. Yields brownish yellow on chrome, alum on iron-mordanted wool and pink on alum-mordanted cotton. Still used in India for dyeing textiles

Literature

Redgrove and Bari-Woolls, *Hair Dyes and Hair Dyeing*, London (1939)
Mayer & Cook, 105
Bhattacharya, 20

C.I. Natural Brown 8

Found as an earthy powder or fragments mixed with wood in peat and lignite beds at Meissner near Cassel, in the neighbourhood of Cologne, etc. It is mined by tunnelling, air dried, ground, sieved and levigated. Consists mainly of humus and humic acid produced by the decay of wood. The constitution of humic acid is still unknown. Polymerised hydroxymethylfurfuraldehyde has the general properties of humic acid, but it has yet to be proved that natural humic acid is a chemical entity—Waksman, *Humus*, London (1938)

Vandyke Brown is a bituminous ferruginous earth

Cappagh Brown, a manganic peat obtained from Cappagh near Cork. It is a deep rich transparent pigment having, because of its manganese content, strong drying properties cf. C.I. 77727

Walnut Stain is obtained by treating Cassel Brown with 6–8% of aqueous sodium carbonate until completely dissolved and then evaporating to dryness

Dries very slowly in oil and has low covering power but finds limited use in the manufacture of coloured paper and wallpaper and as an artist's water and oil colour and for graining and staining wood

Standard BS 319:1937 (Vandyke Brown)

Reactions

Brown solution in alkalis. Decomposed by mineral acids with separation of carbon

Literature

Remington and Francis, *Pigments*, 3rd Ed. London (1954) 143
Wagner, 234

C.I. Natural Brown 9

Dried native sepia (from the ink bags of cuttlefish) contains *c.* 78% melanin, 10% calcium carbonate, 7% magnesium carbonate, 2% alkaline sulphates and chlorides, and 0·8% miscellaneous compounds. Melanin consists of a group of black pigments widely distributed in the animal and vegetable kingdoms, e.g. in hair. The constitution of these pigments has yet to be determined. The sepiomelanin present in sepia is soluble in warm caustic potash to a brown solution from which it is precipitated by hydrochloric acid or sulphuric acid but not by nitric acid, it is soluble in ammonia. It is a macromolecule (probably a mixture of macromolecules). It is used as an artist's water colour but fades perceptibly after two years' exposure to light and air

Literature

Perk, *USP* 2,539,202
Angeli, *Att. R. Acad., Lincei.*, **27** (1918) 417
Heinlein, *Biochem. J.*, **154** (1924) 24
Raper, *ibid.*, **21** (1927) 89, 1370
Spiegel-Adolf and Henney, *JACS*, **61** (1930) 2178
Waelsch, *Z. physiol. Chem.*, **213** (1932) 35
Spiegel-Adolf, *Biochem. J.*, **31** (1937) 1303
Goldsmith, *Thorpe*, **10,** 717
Dufrénoy, *Scientia*, **85** (1950) 1795
Clemo and Duxbury, *JCS*, (1950) 1795
Bullock and Harley-Mason, *ibid.* (1951) 703
Pannizzi and Nicolaus, *Atti. accad. nazl. Lincei, Perd. Classe sci, fis. mat. enat.*, **12,** 420; *Gazz. chim ital.*, **82** (1952) 435
Mason, *Pigment Cell Growth* (*Proc. 3rd. Conf. Biol. Normal and Atyp. Pigment Cell Growth*), (1953) 227
Plummer and Kopac, *ibid.*, 305
Lea, *Nature*, **170** (1952) 709
Cromartie and Harley-Mason, *Chem. Ind.*, (1953) 972
Duxbury, *ibid.*, 1364
Jolles, *ibid.*, 1367
Laxter and Whewell, *ibid.* (1954) 127
Stoves, *ibid.*, 158
Scom and Wright, *ibid.*, 79
Stein, *Nature*, **174** (1954) 601
Nicolaus, *Melanins*, Paris (1968)

C.I. Natural Brown 10

Caramel occurs naturally in some wines. Made by heating glucose or invert sugar until it turns brown to black. A complex mixture of which little is known. Used for colouring food and drinks

Standard

BS 3874:1965 Caramel for use in foodstuffs

Literature

Albrecht, *BP* 346,136
Union Starch & Refining Co., *USP* 2,533,221; 2,582,261
Salamon and Goldie, *JSCI*, **19** (1900) 301
Ronnel, *Ann. Falsif.*, **5** (1912) 517
Beal and Zoller, *J. Amer. Pharm Assoc.*, **3** (1914) 495
Cunningham and Dorée, *JCS*, **111** (1917) 589
Ling and Sanji, *JSCI*, **41** (1922), 151T
Ripp, *Z. Ver. deut. Zucker-Ind.*, (1926) 627
Garino-Carina, *Notiz. chim. ind.*, **2** (1927) 133
Blyth and Cox, *Foods*, 7th Ed., London (1927) 93
Akkermann, *Arch. Suikerind. Ned.-Indie*, **38** (1930) 677
Baja, *Requind*, **1** (1932) 52, 74; **3** (1932) 1100

C.I. Natural Brown 11

Bistre Brownish black bituminous soot obtained usually from beechwood. Similar products are obtained by extracting lignite, tar or humus with ammonia and precipitating the extract with acetic acid. Used as an artists' water colour and in China ink. Unaffected by hydrogen sulphide or sulphur dioxide but oxidised by light and air becoming paler, its permanence depending upon the type of soot from which it has been prepared. Unaffected by acids or alkalis
Mummy A rich brown bituminous pigment used by artists
Bone Brown consists of incompletely charred ivory dust or bones

Reaction

Bone Brown turns white when heated in air

Literature

Remington and Francis, *Pigments*, 3rd Ed., London (1954) 198 (Bistre)

C.I. Natural Brown 12

Produced by treating humus with sodium hydroxide and/or sodium carbonate. This solubilises colorants present in humus which occurs in nature as a result of decomposition of organic matter. It is used almost exclusively in dyeing paper

Hue **Yellowish Brown→Reddish Brown**

NOTES

C.I. 75290

The wood (or its extract) of a tree grown in the W. Indies, British Honduras, Mexico, Mauritius, etc. Logwood extracts and hematine crystals are produced in a variety of strengths and degrees of oxidation—there are a large number of such products and only a broad classification has been adopted

Noir direct is made from unoxidised hematine used for dyeing a full, deep, bloomy black on wool or half wool felts, especially slipper (charentaise) felts

Logwood yields dull bluish violets on an alum mordant, navy to blue black on chrome, blue grey on copper, navy to black on iron, dull reddish violet on tin

DYEING

APPLICATION

Wool Applied on an 'oxidising' or 'reduced' or 'sweet' chrome mordant for producing blacks. For dead blacks Fustic Extract, C.I. Natural Yellow 11, may be used as well or aftertreatment with ferrous sulphate given (saddening). The good fastness to wet processing may be still further improved by chroming and depth may be increased by treatment with ferrous sulphate. May also be applied on an iron mordant using ferrous sulphate together with a little copper sulphate. Single bath methods have been used, e.g., Bonsor's, Gardner's etc., in which the Logwood-iron or -chrome lake is kept in solution by oxalic acid. 'Woaded' blacks are obtained by topping Indigo with logwood

Cotton and Linen Little used now. Dyes black on an iron tannate mordant. Small amounts of copper sulphate may be added to counteract any possible 'rusty' appearance of the dyeing and aftertreament with chrome is beneficial. A variety of single bath methods are available—see Trotman, *Bleaching, Dyeing and Chemical Technology of Textile Fibres*, London (1925), 485

Silk Unweighted silk dyes fine 'bloomy' blacks which give increased weight by use of unoxidised extract or crystals on an iron tannate mordant. Tin phosphate weighted silk is further weighted by dyeing with unoxidised Hematine Crystals from a soap bath, followed by dyeing with fully oxidised Hematine Crystals either without fuller mordanting (for jet blacks) or on an iron-tannate mordant (for blue blacks)

Nylon Dyed from a faintly acid bath with concentrated solutions of unoxidised hematine followed by developing with a 0·25% solution of bichromate acidified with acetic acid. Thorough rinsing between the two treatments is essential

Viscose Rayon Dyed on an iron mordant with fully oxidised hematine

Acetate Dyed from a neutral or slightly acid bath with a concentrated solution of unoxidised hematine followed by treatment with 1·2% bichrome, preferably in absence of acid, cf. C.I. Natural Black 3

Wool-Cotton Mixtures were once largely dyed by treating with a strong decoction of any natural tannin (e.g. C.I. Natural Brown 6), fixing with pyrolignite or iron, washing and chroming (sweet), and finally completing dyeing with Logwood and Fustic

Wool-Nylon Mixtures Dyed as wool, mordanting first with chrome and lactic or formic acid and then dyeing with oxidised hematine

Wool-Viscose Rayon Mixtures Require a double mordant, chrome for the wool and basic ferrous sulphate for the viscose rayon; dye with oxidised hematine

Hair Dyed black on chrome mordant or by treatment with hematine followed by fixing with iron salts

Coir, Jute, etc. Dyed with hematine at the boil, cooled to 40°C, ferrous sulphate added to the liquor, slowly raised at 70°C and kept at that temperature until the correct depth is obtained

FASTNESS PROPERTIES

10% *dyeing on chromed wool*: alkaline milling and perspiration—very good, wool and cotton unstained; potting—very good, wool slightly stained (not stained with after-chrome dyeings); acid spotting—sulphuric acid poor, acetic acid very good; alkali spotting—very good; cross-dyeing—sulphuric acid good to very good, wool slightly stained; light—very good

10% *dyeing on iron-copper mordanted wool*: alkaline milling—very good, wool unstained; potting—good to very good, wool very slightly stained; cross-dyeing sulphuric acid—satisfactory, wool stained; light—excellent

Dyeing on iron-mordanted unweighted silk: degumming—very good, silk unstained; perspiration and alkaline milling—very good, cotton, silk and wool unstained; light—very good to excellent

After-chrome dyeing on nylon: washing—very good, cotton, nylon and wool unstained; perspiration—very good, cotton, nylon and wool unstained; hot pressing, dry and damp—very good, cotton and nylon unstained; alkaline milling—very good, cotton, nylon and wool unstained; cross-dyeing—acetic acid—very good, cotton unstained, nylon and wool slightly stained; sulphuric acid—good to very good, cotton very slightly stained, nylon and wool slightly stained; degumming with silk—good to very good, nylon and silk unstained; acid spotting—acetic acid very good, sulphuric acid poor; alkali spotting—very good; light—very good

After-chrome dyeing on acetate: washing and perspiration—very good, acetate, cotton and silk unstained; hot pressing, dry and damp—very good, acetate and cotton unstained; acid spotting—acetic acid—good to very good, sulphuric acid—poor; alkali spotting—very good; light—good

Literature

Lepetit, Dollfuss and Ganser, *FP* 351,018
Parnell, 35
Napier, 321
Muspratt, 601
Hummel, 319
Manual, 330
Thorpe, **4**, 126; **7**, 518
Trimble, *JSDC*, **1** (1885) 92
Wilkinson, *JSDC*, **2** (1886) 36
Topper, *ibid.*, 76
Palmer, *JSDC*, **5** (1889) 126
Frusler, *JSDC*, **7** (1891) 82
Gardner, *Dyer*, **11** (1891) 6, 21, 37, 52, 90, 106, 122, 140, 158, 176
Austen, *Text. Col.* (1895) 65
Staples, *ibid.* (1921) 463, 528
Craven, *JSDC*, **38** (1922) 108
Krebler, *Text. Weekly*, **4** (1929–30) 390, 455, 526
Isles, *JSDC, Jubilee Issue* (1934) 134
Stansfield, *ibid.*, 139
Isles, *JSDC*, **53** (1937) 417
Hopkinson, Goodall, Peel and Lloyd, *JSDC*, **60** (1944) 328
Tisdale, *Rayon Text.*, **29** (1948) (7) 74
Newsome, *JSDC*, **66** (1950) 277
Bird and Newsome, *ibid.*, 423
Dyer, **104** (1950) 625
Tisdale, *Rayon & Synthetic Textiles*, **32** (1951) (6) 59; *Am. Dy. Rep.*, **46** (1954) 157
Arshid *et al.*, *JSDC*, **70** (1954) 1402
Parsy, *Teintex*, **20** (1955) 859, 951

C.I. Natural Black 1

C.I. 75290 *Continued*

NON-TEXTILE USAGE
Wood, Straw, etc. Dyed with unoxidised hematine and developed in a fresh bath with iron or chrome
Leather Highly oxidised hematine extensively used for blacks, particularly on chrome leather, often in conjunction with other dyes, e.g. Nigrosine or direct blacks. After dyeing the hue is 'struck' by addition of a little ferrous sulphate or titanium potassium oxalate to the extracted liquor. Also used in brush dyeing. Properties on chrome tannage (S.D.C.) Light 5, Penetration 2
Furs Kill with lime, dye with unoxidised or partly oxidised hematine in conjunction with iron and/or copper and/or chromium salts
Sheepskins Dye with hematine and develop with chrome and/or ferrous sulphate. Repeat the process several times to get required depth
In some countries hematine is a permitted dye for food and tobacco
Pure haematin and haematoxylin are used as microscopic stains and pH indicators and for the colorimetric determination of aluminium
Logwood extract and crystals are slightly soluble in cold and soluble in boiling water, solubility decreasing with increasing degree of oxidation

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C.I. Natural Black 2

C.I. 75290

A modified logwood product used to dye blacks on acetate. Dyes nylon slowly from a bath containing a little acetic acid at 70–80°C followed by chroming in a fresh bath. Solid dyeings are obtained on mixtures of lustrous and pigmented fibres and perfect penetration of the most tightly woven cloths. Suitable for jig and beam dyeing of fabric and package dyeing of yarn. Not dischargeable. Staining of effect threads: cotton—s., viscose rayon—s., silk—h.s., wool—h.s.
Fastness (S.D.C. tests on acetate): burnt gas fumes 5, dry cleaning (perchloroethylene) 5, hot pressing 5, hypochlorite 5, light (ISO Rec. R105 Pt. 11) 5 (as a black), perspiration 5, water spotting 5, washing (ISO No. 2) 5/5. Artificial light—unchanged
(S.D.C. tests on nylon): burnt gas fumes 5, dry cleaning (perchloroethylene) 5, light (ISO Rec. R105, Pt. 11) 6–7 (as a black), perspiration 5, washing (ISO No. 3) 5/5

C.I. Natural Black 3

C.I. 75291

The bluish black to black lakes of Logwood Extract with bichromate, ferrous or ferric salts, aluminium or tin salts, used with size to colour paper and with varnish for bleachable printing inks and artists' colours. Solutions in oxalic acid are used as inks. Used in oil or spirit lacquers for fancy goods, leather, celluloid, etc. The lakes are unstable to heat but are very fast to light and are practically unaffected by SO_2 or H_2S
Blue Black is powdered Logwood Black
Black Lake is obtained by heating Logwood extract with potassium dichromate and copper sulphite, it is a dense black but is of poor fastness to light

Reactions

H_2SO_4 conc.—deep red
NaOH 10%—deep violet

Literature

Grandmougin, *Els. Textilblatt.* (1912) 1141
Arshid *et al.*, *JSDC*, **70** (1954) July

C.I. Natural Black 4

C.I. 75291

The soluble bisulphite compounds of logwood lakes used in calico printing. Theoretically no mordant is necessary in the printing paste but in practice it is found that the results may be modified by addition of chromium acetate or pyrolignite of iron which speed up development during steaming
Noir réduit or **Steam Black** are solubilised chrome lakes used for printing on cotton
Printing Black C5 and **Logwood Printing Black C** are used on cotton
Logwood Printing Black V, Printing Black N and **Viscose Printing Black** are used on viscose rayon
Steam Black (JWC) printed on cellulose, silk or wool with chromium acetate or chrome and iron gives blacks of excellent fastness to light and washing, good fastness to chlorine and fair fastness to rubbing

Literature

Grandmougin, *Els. Textilblatt.* (1912) 1141
Knecht & Fothergill, 301, 464, 841
FDX 684 (PB 73, 758)
Dyer, **103** (1950) 30
Arshid *et al.*, *JSDC*, **70** (1954) July

The fermented aqueous extract of privet berries dyes copper-mordanted wool dove grey

C.I. Natural Black 6

Asphalt contains C, H and O and is produced by the action of atmospheric oxygen on high boiling mineral oils. It occurs naturally in various rocks, e.g. sandstone and limestone (Asphaltstone) or more rarely in beds as in Albania (Aolana). The chief deposits are in Trinidad (Pitch lakes), Cuba and Venezuela. Also on the Dead Sea (**Syrian Asphalt**), in Peru, Neufchâtel, etc. Syrian Asphalt is the purest, whereas **Trinidad Asphalt** may contain as much as 35% of mineral matter
Bitumen is lighter in colour than asphalt and consists of mixture of natural and pyrogenous hydrocarbons and their non-metallic derivatives
Asphaltic Bitumen consists of colloidal carbon dispersed in a very complex mixture of hydrocarbons and their sulphur- and nitrogen-containing derivatives
Artificial Asphalt is made by mixing bitumen and mineral matter or by heating coal tar pitch to a high temperature
Artificial Asphaltic Bitumen is obtained by the two-stage distillation of certain crude petroleum oils
Gilsonite is one of the purest natural forms

Formerly used in artists' oil colours. Largely used as brownish black to black pigments in black varnishes and lacquers, e.g. **Japan Lacquer, Brunswick Black,** etc. and in lithographic and photogravure inks

Reactions

Asphalt readily soluble in turpentine and petroleum ether, m.p. 100°C. Tar is detected in asphalt by heating to 200°C, powdering and extracting with hot alcohol, which becomes yellow with a greenish-blue fluorescence, the intensity being dependent on the amount of tar present
Bitumen readily soluble in CS_2

Literature

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Hudson and Stanners, *J. Appl. Chem.*, 5 (1955) 173
Wagner, 234

NOTES

C.I. 75170

Pearl essence is usually a suspension of 11% of guanine crystals in a cellulose nitrate lacquer except when the lacquer is to be used in a plastic when the cellulose nitrate should be substituted by the particular plastic. Used for colouring artificial pearls and other artificial jewellery and fancy goods, and in nail varnishes and wherever a pearl or mother-of-pearl effect is required, and where particularly lustrous lacquers are required

Literature

Kishi, *Rept. Osaka Pref. Ind. Research Inst.*, **1** (1949) 40
Kishi and Kato, *ibid.*, **2** (1950) 42
Obata, Igarashi and Ishida, *Bull. Japan Soc. Sci. Fisheries*, **16** (1950) 141
Krajkeman, *Paint*, **22** (1952) 371 (review of literature including analysis, evaluation and usages)
Decker, *Org. Finishing*, **14** (7) (1953) 11
Groen, *Paint, Oil and Col. J.*, **124** (1953) 602
Pearl Essence. References 1939–54. Science Library Bibliographical Series No. 735 London (Science Library, 1955)

NOTES

OXIDATION BASES

The Oxidation Bases provide the classic example of the synthesis of dyes on the fibre. They were foreshadowed in Runge's experiments (1834) on the oxidation of aniline when he noted various colorations and the formation of a black precipitate.

In the manufacture of Mauveine, Perkin (1856) adopting similar methods (the reaction of aniline sulphate and potassium bichromate) obtained as a by-product a black precipitate. This black precipitate, actually the most abundant product of the reaction, was Aniline Black in substance which later (1862) became valuable as a pigment in calico printing.

That oxidation products of aniline could be successfully formed on the fibre itself was demonstrated by Calvert and his co-workers (1860) when they printed aniline hydrochloride on a cotton fabric prepared in potassium chlorate and produced a colouring matter they called Emeraldine; after-treatment with potassium bichromate and other oxidising agents converted this into very dark, almost black, shades. Lightfoot (1863) so perfected this process that he is generally considered to be the inventor of Aniline Black. His method consisted in applying to the cloth either in the form of a solution or as a printing paste a mixture of aniline hydrochloride, potassium chlorate, and copper chloride which, after hanging for two days, yielded an intense black.

The practical success of Lightfoot's process, together with the supreme importance of such a colouring matter as Aniline Black, led to a considerable amount of activity in this field and as a result innumerable processes for its production on the fibre designed to meet various technical requirements were devised.

The elucidation of the structure and the synthesis of Aniline Black by A. G. Green (1913) completed the investigations of half a century by technical chemists on this important dye. During this period an intensive search was made for other organic bases capable of being applied to textile fibres in a similar fashion but few were found of any value and none of the importance of aniline.

p-Aminodiphenylamine and other bases of the diphenylamine series are used for the production of fast non-greening blacks and, in recent years, sulphamic acid derivatives of aminodiphenylamines having good solubility in a neutral medium, have been used for the production of ungreenable blacks with little risk of tendering.

p-Phenylenediamine provides a fine brown largely used by calico printers.

Application to Furs

The fact that organic bases could be used for colouring hair, fur, etc. was first patented in 1888 by H. Erdmann.[1] This discovery was followed by the introduction in 1895 by the Berlin Aniline Company of a range of bases under the name 'Ursols'.

These and similar compounds, introduced later, possess the property of forming intensely coloured insoluble compounds when treated with oxidising agents. If this oxidation takes place in presence of a mordant, still deeper coloured compounds are produced and a larger variety of colours becomes possible. The results obtained are also influenced by the acidity of alkalinity or the dyebath so that, with comparatively few compounds, a wide range of colours may be obtained.

As would be expected, dyes produced by oxidation and affected by so many agencies require careful treatment at all stages if reproducible and level results are to be obtained, and this is especially so with the preliminary operations such as dressing, tanning, etc., and, in particular, with the operation known as 'killing' which, consisting of a treatment with an alkali, opens up the fibre scales and promotes more rapid and even dyeing. Typical 'killing solutions are: a 1% solution of ammonia or soda-ash; a 0·5–2·5% solution of caustic soda (76°Tw.) or a 1% suspension of slaked lime. The treatment is carried out cold for 2–3 hours after which the skins are well washed and, if necessary, acidified to free from residual aklali. Special effects are obtained by treating the tips separately with either an alkali or peroxide (brush killing).

Iron, chromium, copper and aluminium compounds are generally used for mordanting.

A great variety of colours can be obtained by the use of mixed mordants but, unless the conditions are carefully controlled, difficulties may arise due to the formation of precipitates. This is especially the case when chromium and iron mordants are mixed. The hydroextracted furs are entered into the mordanting solutions at 75°F, agitated and then left to steep overnight. The following morning furs steeped in the iron, alum, or copper mordanting solutions are rinsed and hydroextracted before being dyed but furs mordanted with chromium are hydroextracted without rinsing.

The oxidation bases are generally dissolved by pouring hot water over them and then cooling to the temperature of dyeing (80°F in most cases with an increase to 90°F in the case of blacks). Boiling water should be avoided owing to the risk of oxidation and resinification. Some bases require special preparation and in those cases the recommended method is set out under each individual base.

To the prepared solution of the base is added the recommended amount of ammonia, if any, and the hydrogen peroxide may be added immediately before use or after dyeing has proceeded for a time. The latter procedure assists materially in the production of more uniform dyeings.

The mordanted furs are introduced and kept on the move for the first 30 minutes or so in order to obtain level dyeings and to remove any air bubbles. The temperature should be maintained fairly constant and be carefully controlled as, if too high, the evolution of oxygen will be too rapid and, if too low, the evolution of oxygen will be too slow.

The time of treatment depends on the depth of colour required, on the temperature and on the type of fur, but typical dyeing times are: for greys 2–4 hours, for browns 3–5 hours, and for blacks 12–14 hours, or overnight.

The greatest care should be taken, if it is desired to mix oxidation bases, to determine whether or not the result will lie between the colours normally obtained from the individual bases or will give an anomalous result. Wherever such

information is available it has been included under each individual entry but if it is intended to use other mixtures preliminary trials should be made.

In recent years a number of compounds have been made available to the fur dyer which are more properly described as 'Developers'. They do not dye fur to any extent when used alone but exert a pronounced shading effect when used in conjunction with other oxidation bases. The developers, which are hydroxy derivatives of benzene or naphthalene, may be supplied separately or in mixtures with the base as, e.g., in the Ursatins (FW).

Dyeing may also be carried out by the 'brushing' process by which the base is applied to the hair tips or to selected areas in order to obtain specific effects.

After dyeing, any unoxidised base is removed, first by thorough rinsing and then, after drying at 105°F, by a lengthy treatment with sand and/or sawdust for periods varying from 1–2 hours for greys to 12–18 hours for blacks. During this treatment the temperature must again be watched and, if necessary the treatment made intermittent to allow cooling.

It should be noted that these bases are liable to oxidise on exposure to air and that, therefore, they should be stored in air-tight containers.

The fastness of the dyed furs to storage varies considerably when combinations of bases have been used and this is indicated, as far as possible, in the following pages. By the incorporation of developers the fastness to storing is very considerably increased.

It should be recognised that many of these oxidation bases may cause dermatitis if carelessly handled and cleanliness and caution in handling are essential. There is little risk of dermatitis being caused from the dyed furs if the base is thoroughly oxidised and all loose dye is completely removed.

The oxidation bases may also be used for colouring animal fibres, hair, feathers, etc., the colour being developed with hydrogen peroxide.

Data on the behaviour of one base in presence of another which is either a mixture of two bases or of a base and a developer is not included as introduction of a third component complicates ageing and reaction under varying dyeing conditions. Those commercial products of known constitution which are mixtures of bases or of bases and developers are listed on pp. 3265 and 3266 where reference is made to their composition.

REFERENCES

[1] GP 51073 (Fr. **2**, 499)

LITERATURE (FUR DYEING)

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Forster and Soyka, Fur Dyes, their Oxidation and Identification on the Fibre, *JSDC*, **47** (1931) 99
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BIOS Reports 879 and 1164
BIOS Survey No. 27, p. 55
Standard Poland PN C 07423:1964 Oxidation bases for furs. Methods of testing

LITERATURE (ANILINE BLACK)

See C.I. Oxidation Bases 1, 2 and 3

Note—In the following entries the term 'Oxidation Base' is used to cover amines and their salts as well as hydroxy compounds, often referred to as 'Developers'.

APPLICATION TO COTTON

In the preparation of Mauveine in 1856 substances analogous to the oxidation products of emeraldine were obtained and received considerable attention. Although much research work was carried out in attempts to produce a black from aniline a successful process for the production of Aniline Black on cotton was not worked out until 1863 when J. Lightfoot took out a patent (*BP* 151 of 1863) and for this reason he is generally regarded as its discoverer

Detailed preparations of Aniline Black are not included as these vary according to working conditions but an outline of some of the recognised processes is included to illustrate the principles involved and the general method of development

There are two particular difficulties which arise with Aniline Blacks: (a) cellulose is liable to be tendered by the mineral acid necessary in the earlier stages of oxidation and quinonoid formation and (b) premature formation of the colour must be avoided or it becomes precipitated on the outside of the fibre and the resultant black possesses poor fastness to rubbing and is, moreover on soaping. Most of the modifications to the original process have been introduced to overcome one or both of these difficulties. In spite of the risk of tendering, very large quantities of Aniline Black are dyed and printed successfully by ensuring the rapid removal of deleterious gases during ageing and by using agers sufficiently large to ensure rapid oxidation without excessive fluctuations in temperature

Prussiate or **Steam Aniline Black** This process, invented by Lightfoot in 1863, employs aniline salt, potassium ferrocyanide and sodium chlorate. The colour is developed by ageing at 95°C followed by chroming and soaping

Copper Sulphide Black This important development was introduced by C. Lauth (*BP* 1409 of 1864) and employs aniline salt, aniline oil, sodium chlorate and copper sulphide which, during development, becomes oxidised to the soluble and, therefore, active copper sulphate. The excess aniline serves to promote the formation of the 'ungreenable' black and to decrease risk of tendering. The colour is developed by ageing at not more than 65°C or by hanging in an ageing room at room temperature for 10–24 hours. Oxidation is completed by treatment with a 1% solution of sodium bichromate

A disadvantage of the process is the formation of sludge leading to rubbing difficulties and, in the case of printing, to damage to printing rollers and doctor blades

Copper Sulphocyanide Black In this process, developed by J. Higgin (*BP* 2351 of 1868), copper sulphocyanide replaced copper sulphide. The printing paste was more stable and development was carried out in the rapid ager or by steaming followed by chroming

Chromate Black J. Schmidlin suggested adding lead chromate to the aniline salt and sodium chlorate to act both as an oxidising and neutralising agent. No after-chroming is necessary in this process

Koechlin's Black In this recipe C. Koechlin replaced aniline hydrochloride by aniline tartrate. The colour develops slowly and, after passing through the rapid ager, the material is allowed to hang in an ageing chamber for 24 hours

Aniline tartrate does not itself oxidise to form the Aniline Black which is developed from the aniline hydrochloride produced by the reaction between ammonium chloride and aniline tartrate. After-treatment with sodium bichromate is essential

Vanadium Black J. Lightfoot, F. Witz and A. Guyard found that as little as 1 part of a vanadium salt was sufficient to catalyse the oxidation of 2000 parts of aniline to the black. Ammonium metavanadate was first used but was replaced later by vanadium chloride. Oxidation is very rapid so that the vanadium salt should be added immediately before use. The process is suitable for printing because of its rapid development and freedom from solid matter. In 1909 Friedlander proposed the use of lead metavanadate in order to increase the stability of printing pastes

Single-Bath Aniline Black This process employs aniline, aniline salt, sodium bichromate, iron liquor and sulphuric acid. The material is treated for 1 hour cold after which the temperature is slowly raised to the boil. It is then washed to remove acid and soaped

The hue is dependent on the liquor ratio, temperature and after-treatment. Dyeings are not fast to chlorine, are liable to rub badly and to 'green' with sulphurous acid

The method is used for yarn but rarely for loose cotton or pieces

Aged Aniline Black The process employs aniline salts, sodium chlorate and, sometimes, ammonium chloride together with either copper sulphide, copper sulphate or vanadium chloride

When using copper sulphide dry the impregnated material, age at 60°C, chrome and soap or develop by hanging, thus greatly reducing the danger of tendering the fibre

When using copper sulphate dry at low temperature, age in a steam ager under controlled humidity at 35°C, chrome with acid sodium bichromate, wash and soap

When using vanadium chloride dry, develop by ageing at 95°C or by hanging. Further development with bichromate is unnecessary

Sterling Black According to this process aniline nitrate-acetate is used in place of the hydrochloride, copper nitrate being used as catalyst. It is claimed that subsequent treatment with bichromate is either unnecessary or may be used with weaker solutions

For details of the reaction and stages in the development of Aniline Black from aniline *see* C.I. 76000

HUE Black

USAGE

In addition to its use in dyeing cotton fabrics Aniline Black is largely used in calico printing, for direct prints as well as for resist and discharge styles

It is largely used for silk-cotton umbrella cloths and finds use as a pigment, C.I. Pigment Black 1, and for colouring furs

Note In general all Aniline Blacks are improved by chroming and an addition of a small quantity of any arylamine such as aniline or *p*-phenylenediamine gives a black which retains its colour and resists 'greening'. Over-oxidation produces bronzy blacks but these may generally be corrected by treatment with an acid reducing agent

The amount of Aniline Black on the fibre may be estimated by determination of the nitrogen content (Aniline Black contains 15·5% N)

APPLICATION TO SILK

Although great care is necessary both to obtain level results and to prevent damage to silk from the free hydrochloric acid present when dyeing with Aniline Black this method of colouring umbrella cloths, etc. consisting of mixtures of silk and cotton is widely adopted

Among early methods of dyeing silk are those of:

Gonin and **Glanzmann** (*FP* 82552) who used potassium chlorate, ammonium chloride, aniline salt and aniline nitrate. The colour was developed preferably by moist heat[6]

Lauth (*FP* 82554) fixed highly oxidised compounds such as barium or copper manganates or permanganates or lead peroxide on the fibre and then entered the silk into a dyeliquor containing aniline and hydrochloric acid[6]

Steinbeck mixed aniline oxalate, cupric chromate and sodium chlorate just before use, entered the silk cold and warmed gently to 65–70°C in 2 hours. The colour was subsequently chromed, washed and soaped[6]

In more recent years it has been claimed that an addition of oxalic acid or of ammonium oxalate to a mixture of aniline hydrochloride and sodium bichromate accelerates and simplifies the formation of Aniline Black. Steaming is unnecessary. The process is more suitable for printing than for dyeing[5]

APPLICATION TO WOOL

Aniline Black does not develop easily on wool and silk owing to the reducing action of the fibre but Justin-Mueller[7] claims that wool may be successfully dyed if excessive oxidation is avoided. In practice, however, wool is seldom dyed with this colour because satisfactory ranges of fast chrome blacks are available

A method used on silk and mohair pile fabrics for the production of blacks with white tips is to treat the fibre cold with a solution of potassium permanganate containing zinc or magnesium sulphate to

neutralise any caustic potash formed during the course of the reaction. The manganese oxides are removed from the tips by treatment with a mixture of hydrogen peroxide, acetic and oxalic acids and the black on the rest of the fibre developed by a treatment in a solution containing aniline oil and sulphuric acid followed by soaping in the presence of a little ammonia. Chinchilla effects may be produced in a similar manner by reducing the quantities of permanganate and aniline oil[8]

APPLICATION TO ACETATE

Unless swelling agents such as formic acid, glacial acetic acid or alcohol are present cellulose acetate is only superficially stained with Aniline Black. Under these conditions, modified copper processes and the use of comparatively large amounts of oxidising agent give satisfactory results

FASTNESS ON CELLULOSE (C.I. 870) (1st Ed.)—unconfirmed

Well dyed Aniline Black is one of the fastest and most intense blacks which can be produced. It is unaltered by light, acids or alkalis
The tendency of Aniline Black to become green may be tested by warming with a moderately concentrated solution of sodium bisulphite, washing and drying. If the black is unaltered by this treatment it will not 'green' on exposure

References

[1] Noelting and Lehne, *Aniline Black*
[2] Knecht and Fothergill, *Principles and Practice of Textile Printing*, 321, 929
[3] Whittaker and Wilcock, *Dyeing with Coal Tar Dyestuffs*, 5th Ed., 213
[4] *Venkataraman*, 778
[5] Piccard, The influence of oxalic acid on the formation of Aniline Black, *Helv. Chim. Acta* (1923) 1029
[6] Gandswindt, *Dyeing Silk, Mixed Silk Fabrics and Artficial Silks* (1921)
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C.I. 76085 C.I. Oxidation Base 2

APPLICATION (textile)

It is dissolved in a mixture of glacial acetic and lactic acids which is mixed, just before use, with an aq. soln of aluminium chloride, copper chlorate and sodium chlorate. The textile is impregnated or printed, dried and developed in a rapid ager for 2–3 min. at as high a temperature as possible to produce ungreenable blacks. Cerium chloride may replace part of the copper chloride. Presence of other dyes may necessitate longer steaming but as no mineral acid is present there is no risk of tendering. Afterchroming should be avoided as an undesirable brown tone develops

Note 4% of C.I. Oxidation Base 2 produces a black similar to that obtained with 8% of C.I. Oxidation Base 1

FASTNESS ON CELLULOSE (AATCC): Hypochlorite 3, Light (as black) 7, Washing (III) 5; (ISO) Acid (organic) 4–5, Alkali 4, Light 5, 6, 7, Washing 5

USAGE

For ungreenable blacks on cellulose and acetate. Used alone for delicate line effects and, in conjunction with C.I. Oxidation Base 1, for black and white effects

Literature

M.L.B., *BP* 15062/01, *FP* 313035, *GP* 134559 (*Fr.* **6**, 1062)
B.C., *BP* 255962

C.I. 76086 C.I. Oxidation Base 2A
C.I. 76087 C.I. Oxidation Base 2B

APPLICATION (fur)

Paste with alcohol and dissolve in warm water. This yields an acidic solution. Apply in presence of hydrogen peroxide, either neutral to acidiped furs or from an acid bath to furs unmordanted or mordanted with iron, copper or chromium. Excess acid results in weaker and greener greys while presence of alkali results in weaker and redder dyeings, but this redness can be corrected by addition of, e.g. C.I. Oxidation Base 2 or 26

Hue on fur

	Acid	*Alkali*
UNMORDANTED	grey	reddish grey
IRON MORDANT	grey	reddish grey
COPPER MORDANT	grey	black
CHROMIUM MORDANT	grey	dark reddish grey

Fastness to storage

Good on copper mordant. Moderate when unmordanted or on aluminium, chromium or iron mordants
Good when used together with C.I. Oxidation Bases 8, 10, 10A, 11, 13A, 14, 26
Moderate with C.I. Oxidation Bases 6, 20

Behaviour in mixtures

Additive with C.I. Oxidation Bases 6, 6A, 7, 8, 9A, 10A, 13A, 18, 21, 22, 25, 31
Anomalous with C.I. Oxidation Bases 11, 12A, 14, 17, 20, 26, 33

See also C.I. Developer 15

Sulphamate of an amino derivative of diphenylamine

C.I. Oxidation Base 3

Readily dissolves in water to yield stable solutions or printing pastes to which are added an ammonium salt, e.g. ammonium oxalate, as acid producing agent, sodium or ammonium chlorate as oxidising agent and ammonium vanadate as catalyst. It is used for direct print styles, resist styles and pad-dyeing. As it may be developed either neutral or acid it may be used alongside vat, solubilised vat and azoic dyes. It is not suitable for greys
It may be applied to mordanted or unmordanted furs, neutral or acid, in presence of hydrogen peroxide

Literature

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Francolor, *BP* 730106
S. A. St Denis, *BP* 498755, *FP* 820395, *GP* 716299
Zuber and Jomain, *JSDC*, **68** (1952) 241

C.I. 76043 C.I. Oxidation Base 4

Pasted with alcohol and dissolved in warm water it dyes furs deep browns on copper, chromium and iron mordants in presence of hydrogen peroxide

Fastness to storage

Good on copper and iron mordants, moderate on chromium mordant and poor on aluminium mordant or when unmordanted

C.I. Oxidation Base 5

Dissolved in hot water and applied from neutral or acid solution containing hydrogen peroxide it yields reddish browns on copper and yellowish browns on chromium mordanted furs

C.I. 76550 C.I. Oxidation Base 6
C.I. 76551 C.I. Oxidation Base 6A

SOLUTION

Readily soluble in hot water
Reaction in solution – C.I. Oxidation Base 6, neutral
C.I. Oxidation Base 6A, acidic

APPLICATION (fur)

C.I. Oxidation Base 6 applied neutral, and C.I. Oxidation Base A6 alkaline, in presence of hydrogen peroxide, as a basis for medium browns, yellower browns on copper and reddish browns on both iron and chromium mordants and for the toning of greys

Hue on furs	*Acid*	*Alkaline*
UNMORDANTED	dull beige	brown
IRON MORDANT	dull brown	reddish brown
COPPER MORDANT	yellowish brown	brown
CHROMIUM MORDANT	reddish brown	brown

Fastness to storage in mixtures
Good with C.I. Oxidation Bases 8, 11, 13A, 26
Moderate with C.I. Oxidation Bases 2, 10, 10A
Poor with C.I. Oxidation Bases 14, 20

Behaviour in mixtures
Additive with C.I. Oxidation Bases 2, 7, 8, 10, 10A, 11, 13A, 26, 31
Anomalous with C.I. Oxidation Bases 14, 20

APPLICATION (textile)

For printing cellulosic materials with addition of sodium chlorate and vanadium chloride

DISCHARGEABILITY poor

FASTNESS ON CELLULOSE (ISO): Acid (organic) 4, Alkali 2–3, Light 1–2, 2, 2–3, Washing 4

C.I. 76545 C.I. Oxidation Base 7

SOLUTION

Readily soluble in hot water

APPLICATION

On mordanted or unmordanted furs in presence of hydrogen peroxide and another oxidation base. Presence of ammonia is not essential. Mainly as a developer in conjunction with other oxidation bases. For shading towards yellow, for olive greens when used with C.I. Oxidation Base 10, and for bluish greys when used in conjunction with C.I. Oxidation Base 8

Hue on furs	*Acid*	*Alkaline*
IRON MORDANT	almost colourless	almost colourless
COPPER MORDANT	greenish fawn	greenish fawn
CHROMIUM MORDANT	fawn	fawn

Fastness to storage – good

Fastness to storage in mixtures
Good with C.I. Oxidation Bases 6, 8, 10, 11
Moderate with C.I. Oxidation Base 20

Behaviour in mixtures
Additive with most oxidation bases
Anomalous with C.I. Oxidation Bases 8, 10, 10A

C.I. 76075 C.I. Oxidation Base 8
C.I. 76076 C.I. Oxidation Base 8A
C.I. 76077 C.I. Oxidation Base 8B

SOLUTION

Paste with alcohol and dissolve in warm water. Soluble in water, alcohol
Reaction in solution – acidic

APPLICATION

To mordanted or unmordanted furs in presence of hydrogen peroxide with or without an addition of ammonia. For bluish greys on furs mordanted with a chromium salt or when used in combination with C.I. Oxidation Bases 7, 12A, 26 or 33. Bluer greys are also obtained when dyeing is carried out under slightly alkaline conditions. For neutral greys when dyed on furs mordanted with copper salts. For use as a dulling agent

Hue on fur	*Acid*	*Alkaline*
UNMORDANTED	reddish grey	greenish grey
IRON MORDANT	bluish grey	greenish grey
COPPER MORDANT	bluish grey	dark grey
CHROMIUM MORDANT	pale grey	grey

Fastness to storage*
Good on copper mordant
Moderate on chromium and iron mordants
Poor on aluminium mordant and unmordanted

Fastness to storage in mixtures
Good with C.I. Oxidation Bases 2, 6, 7, 8, 11, 12, 13A, 14, 26
Moderate with C.I. Oxidation Bases 10, 10A
Poor with C.I. Oxidation Base 20

Behaviour in mixtures
Additive with C.I. Oxidation Bases 2, 6, 13A, 31
Anomalous with C.I. Oxidation Bases 7, 11, 12, 14, 20, 26, 33

**Note* This base darkens to a black during storage without effect on its suitability for use but should it later become sticky it should be discarded

C.I. 76021 C.I. Oxidation Base 9A

SOLUTION

Paste with alcohol and dissolve in warm water. Soluble in water, alcohol
Reaction in solution – acidic

APPLICATION

On furs, mordanted or unmordanted, with or without presence of hydrogen peroxide, particularly as a yellow shading agent

Hue on fur	*Acid*	*Alkaline*
UNMORDANTED	bright yellow	...
IRON MORDANT	yellow	dull yellow
COPPER MORDANT	greenish yellow	greenish yellow
CHROMIUM MORDANT	yellowish brown	dull yellow

Fastness to storage
Good on copper mordant
Moderate on iron, chromium or alum mordants, or when unmordanted

Behaviour in mixtures
Additive with all oxidation bases

C.I. 76060 C.I. Oxidation Base 10
C.I. 76061 C.I. Oxidation Base 10A

SOLUTION

Readily soluble in hot water
Reaction in solution – Oxidation Base 10, weakly alkaline
Oxidation Base 10A, acidic

APPLICATION (fur)

From a neutral or weakly alkaline bath, containing hydrogen peroxide, for deep blacks on copper, copper-iron and chromium-mordanted fur; bluer when used in conjunction with C.I. Oxidation Bases 14 or 25. For greys when used in conjunction with C.I. Oxidation Base 26

Hue on fur	*Acid*	*Alkaline*
Unmordanted	reddish grey	dull violet
Iron Mordant	brownish grey	grey
Copper Mordant	grey	black
Chromium Mordant	fawn	reddish brown

Fastness to storage in mixtures
Good with C.I. Oxidation Bases 2, 11, 13A, 26
Moderate with C.I. Oxidation Bases 6, 8, 14
Poor with C.I. Oxidation Base 20

Behaviour in mixtures
Additive with C.I. Oxidation Bases 2, 6, 8, 11, 13A, 31
Anomalous with C.I. Oxidation Bases, 7, 12, 14, 20, 26

APPLICATION (textile)

For printing on cellulosic materials with an addition of sodium chlorate and vanadium chloride

Fastness on Cellulose (ISO): Acid (organic) 4, Alkali, 3, Light 1–2, 2, 2–3, Washing 4

See also C.I. Developer 13

C.I. 76521 C.I. Oxidation Base 11

SOLUTION

Paste with alcohol and dissolve in warm water. Soluble in water, alcohol

APPLICATION

On chromium, copper or iron-mordanted fur in presence of hydrogen peroxide, for yellows and yellowish browns when applied in acid or alkaline solution
Slightly stronger dyeing are obtained when applied neutral

Hue on fur	*Acid*	*Alkaline*
Unmordanted	yellowish brown	yellowish brown
Iron Mordant	yellowish brown	yellowish brown
Copper Mordant	dull yellowish brown	tan
Chromium Mordant	yellowish tan	yellowish tan

Fastness to storage in mixtures
Good with C.I. Oxidation Bases 2, 6, 8, 10, 10A, 13A, 14, 26
Moderate with C.I. Oxidation Base 20

Behaviour in mixtures
Additive with other oxidation bases in both acid and alkaline solutions

C.I. Oxidation Base 11:1

Somewhat differently chemically from C.I. Oxidation Base 11 but very similar in properties and uses

C.I. 76050 C.I. Oxidation Base 12
C.I. 76051 C.I. Oxidation Base 12A

SOLUTION

Readily soluble in hot water to an acidic solution

APPLICATION

On mordanted or unmordanted furs in the presence of hydrogen peroxide. When using C.I. Oxidation Base 12A an addition of ammonia must be made. Mainly as a developer for use with other oxidation bases
For yellowish greys on copper mordants, neutral greys on iron mordants, blues fast to storing when used with C.I. Oxidation Bases 10 and 20, reddish browns when used with C.I. Oxidation Base 6 and shading towards blue with C.I. Oxidation Bases 2, 8, 10, 12A

Hue on fur	*Acid*	*Alkaline*
Unmordanted		reddish grey
Iron Mordant	grey	brownish grey
Copper Mordant	grey	dull brown
Chromium Mordant	brownish grey	greyish brown

Fastness to storage – good

Fastness to storage in mixtures – good

Behaviour in mixtures
Additive with C.I. Oxidation Bases 7, 9A, 11, 17, 18, 20, 21, 22, 25, 33
Anomalous with C.I. Oxidation Bases 2A, 6, 8, 10, 13A

C.I. 76066 C.I. Oxidation Base 13A

SOLUTION

Dissolve in boiling water and allow to stand
Reaction in solution – acidic

APPLICATION

From weakly alkaline solution containing hydrogen peroxide on mordanted or unmordanted fur, for russets, browns and beiges; for tints and for toning

Hue on fur	*Acid*	*Alkali*
Unmordanted	brownish grey	reddish fawn
Iron Mordant	brownish grey	reddish fawn
Copper Mordant	brownish grey	reddish nigger brown
Chromium Mordant	brownish grey	dark reddish brown

Fastness to storage
Good on furs mordanted with copper, chromium or iron salts
Moderate on unmordanted or aluminium-mordanted furs

Fastness to storage in mixtures
Good with C.I. Oxidation Bases 2, 6, 8, 10, 10A, 11, 26
Poor with C.I. Oxidation Bases 14, 20

Behaviour in mixtures
Additive with C.I. Oxidation Bases 2, 8, 10, 10A
Anomalous with C.I. Oxidation Bases 6, 14, 20, 26

C.I. 76055 C.I. Oxidation Base 14
C.I. 76056 C.I. Oxidation Base 14A

SOLUTION

Paste with alcohol and dissolve in warm water. Soluble in water, alcohol
Reaction of C.I. Oxidation Base 14A in solution – acidic

APPLICATION

To furs, mordanted or unmordanted, in presence of hydrogen peroxide for blues when used in mixtures with the majority of other oxidation bases. For reddish browns when used with C.I. Oxidation Bases 6 and 6A

Hue on fur	*Acid*	*Alkaline*
Unmordanted	fawn	fawn
Iron Mordant	fawn	fawn
Copper Mordant	fawn	dark brown
Chromium Mordant	beige	dark brown

Fastness to storage in mixtures
Good with C.I. Oxidation Bases 2, 8, 11, 20, 26
Moderate with C.I. Oxidation Bases 10, 10A, 13A
Poor with C.I. Oxidation Bases 6, 6A

Behaviour in mixtures
Additive with C.I. Oxidation Bases 11, 20, 26, 31
Anomalous with C.I. Oxidation Bases 2, 6, 6A, 8, 10, 10A, 13A

C.I. 76610 C.I. Oxidation Base 15

SOLUTION

Paste with alcohol and dissolve in warm water

APPLICATION (fur)

On mordanted or unmordanted furs in presence of hydrogen peroxide, with or without the addition of ammonia, for reddish browns on copper mordants and greenish browns on iron mordants
For shading towards the reddish-brown on iron or chromium mordants; towards the greenish-brown on copper mordants and towards the yellow when unmordanted

Fastness to storage
Moderate on iron or copper mordants
Poor when unmordanted or on chromium or aluminium mordants

APPLICATION (textile)

For dyeing and printing cotton, linen, jute, ramie and viscose

C.I. 76010 C.I. Oxidation Base 16

APPLICATION

Dissolve in hot water and apply from neutral solution, in presence of hydrogen peroxide, on furs mordanted with copper, chromium or iron salts. Gives reddish browns on chromium and nigger browns on copper-mordanted furs

C.I. 76520 C.I. Oxidation Base 17

SOLUTION

Paste with alcohol and dissolve in warm water

APPLICATION

For furs, mordanted or unmordanted, preferably neutral. Alkaline application gives paler and weaker hues. For shading greys and browns towards brownish yellow

Hue on fur	*Acid*	*Alkaline*
Unmordanted	yellow	
Iron Mordant	yellowish brown	dull yellow
Copper Mordant	brown	greenish grey
Chromium Mordant	deep yellow	greenish yellow

Fastness to storage
Good

Behaviour in mixtures
Anomalous with C.I. Oxidation Bases 2A, 8

C.I. 76525 C.I. Oxidation Base 18

SOLUTION

Paste with alcohol and dissolve in warm water. Soluble in water, alcohol

APPLICATION

On mordanted furs in presence of hydrogen peroxide
From ammoniacal solutions weaker though faster dyeings are obtained

Fastness to storage
Moderate on iron, chromium or copper mordants
Poor on aluminium mordant

Behaviour in mixtures
Additive with all other oxidation bases

USAGE (fur)

For browns on all mordants

C.I. 76005 C.I. Oxidation Base 19

Paste with alcohol and dissolve in warm water and apply to mordanted furs in presence of hydrogen peroxide for beiges on a copper mordant and for shading other bases towards yellowish brown

Fastness to storage
Moderate on all mordants

C.I. 76035 C.I. Oxidation Base 20

Pasted with alcohol and dissolved in warm water it is used in presence of hydrogen peroxide for greys on copper mordants and beiges on chrome mordants. Principally for blues in combination with C.I. Oxidation Bases 8, 10 and 13A; bluish violets with C.I. Oxidation Base 6 and reddish browns when dyed alkaline with C.I. Oxidation Base 6

Hue on fur	*Acid*	*Alkaline*
Unmordanted	almost colourless	almost colourless
Iron Mordant	dull yellow	little affinity
Copper Mordant	dull brown	dull brown
Chromium Mordant	mid brown	mid brown

Fastness to storage in mixtures
Good with C.I. Oxidation Bases 14, 26
Moderate with C.I. Oxidation Base 11
Poor with C.I. Oxidation Bases 2, 6, 8, 10, 13A

Behaviour in mixtures
Additive with C.I. Oxidation Bases 11, 14, 26
Anomalous with C.I. Oxidation Bases 2, 6, 8, 10, 13A

See also C.I. Developer 14

C.I. 76540 C.I. Oxidation Base 21

Pasted with alcohol and dissolved in warm water it is used in neutral solution for deep reddish browns on chromium mordant; as a developer and, in combination with other oxidation bases, for shading towards reddish brown
Weaker and yellower dyeings are obtained when an ammoniacal solution is used

Hue on fur

UNMORDANTED	orange
IRON MORDANT	reddish orange
COPPER MORDANT	dull orange
CHROMIUM MORDANT	dull orange

Fastness to storage
Good on copper and chromium mordants, moderate on iron mordant and unmordanted

Behaviour in mixtures
Additive with all oxidation bases

C.I. 76070 C.I. Oxidation Base 22

SOLUTION
Pasted with alcohol and dissolved in warm water it is applied to mordanted or unmordanted furs, neutral or alkaline with or without addition of hydrogen peroxide. From ammoniacal solution slightly yellower dyeings are obtained. For shading towards red when used with other oxidation bases

Hue on fur	*Acid*	*Alkaline*
UNMORDANTED	bright reddish brown	
IRON MORDANT	dull reddish brown	dull reddish brown
COPPER MORDANT	brown	brown
CHROMIUM MORDANT	reddish brown	reddish brown

Fastness to storage
Good on copper, chromium and iron mordants, moderate on aluminium mordant and unmordanted

Behaviour in mixtures
Additive with all other oxidation bases

C.I. Oxidation Base 23

Dissolved in hot water it is applied from neutral solution, in presence of hydrogen peroxide, on furs mordanted with copper, chromium or iron salts to produce greenish yellow, dull yellow and pale browns

C.I. Oxidation Base 24

Dissolved in hot water it is applied from neutral or acid solution, in presence of hydrogen peroxide, to dye furs mordanted with copper, chromium or iron salts beige and reddish browns

C.I. 76555 C.I. Oxidation Base 25

Dissolved in hot water it is applied from neutral or acid solution, in presence of hydrogen peroxide, to produce beige or deep reddish browns on furs mordanted with copper, chromium or iron salts

C.I. 76500 C.I. Oxidation Base 26

Readily soluble in water to weakly acidic solution it is not satisfactory for self dyeings. Used in mixtures gives bluish greys or blues. It also dulls dyeings obtained with other oxidation bases

Hue on fur	*Acid*	*Alkaline*
UNMORDANTED	very slight tint	uncoloured
IRON MORDANTED	pale fawn	pale grey
COPPER MORDANT	greenish brown	beige
CHROMIUM MORDANT	dark brown	brown

Fastness to storage in mixtures
Good

Behaviour in mixtures
Additive with C.I. Oxidation Bases 6, 11, 14, 20, 31
Anomalous with C.I. Oxidation Bases 2, 8, 10, 10A, 13A

C.I. 76090 C.I. Oxidation Base 27

Paste with alcohol and dissolve in warm water (140–160°F). Water of higher temperature should not be used. If the water is hard a small quantity of acetic acid should be added. It dyes furs grey from an acid bath containing hydrogen peroxide

Fastness to storage in mixtures
Poor with C.I. Oxidation Base 20

Behaviour in mixtures
Anomalous with C.I. Oxidation Bases 7, 12A, 33

C.I. Oxidation Base 28

APPLICATION PRINTING
Possesses good solubility in water and in neutral media giving printing pastes of good stability
After printing and drying the colour is developed by a neutral or acid steaming

FASTNESS ON CELLULOSE (ISO): Hypochlorite 1–2, Light 5, 6, 7, Washing (alteration) 5, (staining) 5

USAGE (textile)
For printing deep browns on cellulosic materials, wool and silk, alone and alongside azoic, vat, solubilised vat and chrome colours but must, itself, be maintained and developed acid

HUE – Dull Brown→Chocolate

C.I. Oxidation Base 29

APPLICATION
Dissolved in hot water it is used in presence of hydrogen peroxide to produce dark browns on copper-mordanted furs and reddish brown on chromium-mordanted furs

C.I. Oxidation Base 30

Dissolved in hot water it is applied from neutral, acid or alkaline solution, in presence of hydrogen peroxide, to furs mordanted with copper, chromium or iron salts. Particularly useful for shading additive oxidation bases towards yellow

C.I. 76505 C.I. Oxidation Base 31

Pasted in alcohol and dissolved in warm water it is used on mordanted or unmordanted furs in presence of hydrogen peroxide mainly as a developer in combination with other oxidation bases for shading towards yellowish brown but giving bluer tones with C.I. Oxidation Bases 2, 8, 12, 12A, 13A, 14

See also C.I. Developer 4

C.I. 76515 C.I. Oxidation Base 32

Pasted with alcohol and dissolved in warm water it is used as a developer and for shading towards yellowish brown furs, mordanted or unmordanted, in presence of hydrogen peroxide and ammonia

C.I. 76605 C.I. Oxidation Base 33

Pasted with a little caustic soda and dissolved in hot water used on mordanted or unmordanted furs in presence of hydrogen peroxide. Used alone yields only pale dyeings
Gives blues with C.I. Oxidation Bases 8 and 10 and reddish browns with C.I. Oxidation Bases 6 and 6A

Hue on fur	*Acid*	*Alkaline*
IRON MORDANT	almost colourless	almost colourless
COPPER MORDANT	brownish grey	greenish grey
CHROMIUM MORDANT	dull yellow	dull yellow

Behaviour in mixtures
Additive with C.I. Oxidation Bases 7, 9A, 11, 12A, 13A, 17, 18, 20, 21, 22, 25
Anomalous with C.I. Oxidation Bases 2A, 6A, 8, 10, 10A

Diphenylamine C.I. Oxidation Base 34

SOLUTION
Readily soluble in water

APPLICATION PRINTING

Cellulose By printing from a paste containing an acid donor, an oxidising agent and an oxidation catalyst. Stable in slightly alkaline (ammonia) solution but developed on the fibre by neutral or acid steaming or by merely hanging. For printing cotton and rayon deep black in direct and white and coloured resist styles. Suitable for use with vat dyes and azoic compositions

DYEING

Cellulose By padding

FASTNESS ON COTTON (ISO): Hypochlorite (*a*) 3–4 (yellower), 4–5, (*b*) 2 (yellower), 4–5, Light 7, Peroxide bleaching (*b*) 5, 4, 4–5, Soda boil (*a*) 5, 3–4, (*b*) 4–5, 2–3. Washing (*c*) 4–5, 5, 5

C.I. Oxidation Base 35

This C.I. Generic Name is discontinued, the oxidation base formerly listed under it now appears under C.I. Oxidation Base 20

OXIDATION BASES—MIXTURES OF KNOWN CONSTITUTION

BASF Ursol A	BASF	C.I. 76060+C.I. 76050
BASF Ursol DF	BASF	C.I. 76060+C.I. 76050
BASF Ursol NZ	BASF	C.I. 76060+C.I. 76505
BASF Ursol RHG	BASF	C.I. 76060+C.I. 76505
BASF Ursol Fast Black	BASF	C.I. 76060+C.I. 76635
BASF Ursol Black DB	BASF	C.I. 76060+C.I. 76035
BASF Ursol Grey BC	BASF	C.I. 76060+C.I. 76500
Benzofur MZ	Chem	C.I. 76060+C.I. 76505
Durafur Black B	ICI	C.I. 76060+C.I. 76035
Durafur Black 6B	ICI	C.I. 76061+C.I. 76051 +C.I. 76076
Durafur Black LDB	ICI	C.I. 76060+C.I. 76035
Durafur Dark Brown 2G	ICI	C.I. 76060+C.I. 76505
Durafur Dark Brown GR	ICI	C.I. 76060+C.I. 76505
Eucanine A	Gy	C.I. 76060+C.I. 76050
Eucanine SA	Gy	C.I. 76061+C.I. 76051
Eucanine SB	Gy	C.I. 76061+C.I. 76051 +C.I. 76076
Fouramine NZ	Fran	C.I. 76060+C.I. 76050
Furro A	FDN	C.I. 76060+C.I. 76050
Furro DB	FDN	C.I. 76060+C.I. 76035
Furro DF	FDN	C.I. 76060+C.I. 76050
Furro DG	FDN	C.I. 76060+C.I. 76020
Furro NZ	FDN	C.I. 76060+C.I. 76505
Furro NZD	FDN	C.I. 76060+C.I. 76505
Furro RH	FDN	C.I. 76060+C.I. 76505 +C.I. 10316
Furro RHG	FDN	C.I. 76060+C.I. 76505
Furro SA	FDN	C.I. 76061+C.I. 76051
Furro SB	FDN	C.I. 76061+C.I. 76051 +C.I. 76076
Furro SK	FDN	C.I. 76060+C.I. 76551 +C.I. 76505
Furro SKG	FDN	C.I. 76060+C.I. 76521 +C.I. 76505
Furro Blue Black B	FDN	C.I. 76060+C.I. 76050 +C.I. 76076
Futramine DD	Pol	C.I. 76060+C.I. 76035
Futramine NZ	Pol	C.I. 76060+C.I. 76505
Futramine RHG	Pol	C.I. 76060+C.I. 76505
Nako Black RNB	FH	C.I. 76060+C.I. 76635
Nako Brown G	FH	C.I. 76060+C.I. 76505
Nako Brown GG	FH	C.I. 76060+C.I. 76505
Nako Dark Blue AN	FH	C.I. 76060+C.I. 76050
Nako Grey BK	FH	C.I. 76060+C.I. 76500
Nyanzol NZA	NCC	C.I. 76060+C.I. 76505
Nyanzol NZDA	NCC	C.I. 76060+C.I. 76505
Pelagol A	Saic	C.I. 76060+C.I. 76050
Pelagol DB	Saic	C.I. 76060+C.I. 76035
Pelagol DBC	Saic	C.I. 76060+C.I. 76035
Pelagol DF	Saic	C.I. 76060+C.I. 76050
Pelagol NDZ	Saic	C.I. 76060+C.I. 76505
Pelagol NZ	Saic	C.I. 76060+C.I. 76505
Pelagol RH	Saic	C.I. 76060+C.I. 76505 +C.I. 10316
Pelagol RHG	Saic	C.I. 76060+C.I. 76505
Pelagol SA	Saic	C.I. 76061+C.I. 76051
Pelagol SK	Saic	C.I. 76060+C.I. 76551 +C.I. 76505
Pelagol SKG	Saic	C.I. 76060+C.I. 76521 +C.I. 76505

Pelagol SP	Saic	C.I. 76011+C.I. 76060 +C.I. 76505
Pelagol Grey BC	Saic	C.I. 76060+C.I. 76500
Renal DB	Acna	C.I. 76060+C.I. 76035
Renal DG	Acna	C.I. 76060+C.I. 76035
Renal N	Acna	C.I. 76060+C.I. 76050
Renal NZ	Acna	C.I. 76060+C.I. 76505
Ursamol Black BR	FW	C.I. 76605+C.I. 76060
Ursatin Brown	FW	C.I. 76035+C.I. 76625
Ursatin Violet	FW	C.I. 76065+C.I. 76625
Ursatin Yellow Brown	FW	C.I. 76625+C.I. 76030
Ursol A	FW	C.I. 76060+C.I. 76050
Ursol DF	FW	C.I. 76060+C.I. 76050
Ursol EWG	FW	C.I. 76505+C.I. 76510
Ursol NZ	FW	C.I. 76060+C.I. 76505
Ursol SA	FW	C.I. 76061+C.I. 76051
Ursol SB	FW	C.I. 76061+C.I. 76051 +C.I. 76076
Ursol Black DB	BASF, FW	C.I. 76060+C.I. 76035
Ursol Black F	FW	Phenol+C.I. 76060
Ursol Black Oil ST	FW	C.I. 76001+C.I. 76061 +C.I. 76036
Zoba EWG	FBy	C.I. 76505+C.I. 76510
Zoba Black A (water soluble)	FBy	C.I. 76060+C.I. 76050
Zoba Blue Black DB	FBy	C.I. 76060+C.I. 76035
Zoba Brown B	FBy	C.I. 76035+C.I. 76625
Zoba Brown NZ	FBy	C.I. 76060+C.I. 76505
Zoba Grey BC	FBy	C.I. 76060+C.I. 76500
Zoba Grounding Black ST	FBy	C.I. 76001+C.I. 76061 +C.I. 76036
Zoba Violet B	FBy	C.I. 76065+C.I. 76625
Zoba Yellow Brown G	FBy	C.I. 76625+C.I. 76030

NOTES

PIGMENTS

The process of colouring with pigments is the apparently simple one of incorporating the pigment in a medium in which it is, by definition, insoluble or substantially so. The physical condition of a pigment is a matter of considerable importance since it may affect ease of incorporation into the medium, hue, tinctorial strength, transparency or opacity, the capacity to absorb the vehicle and the rheology of the resulting system. Chemical interaction between pigment and medium may occur in some instances e.g. if a basic pigment such as zinc oxide is used with a medium of high acid value.

Chemical Constitution

Particulars of chemical constitution are given under the general heading of chemical class accompanied by the C.I. Constitution Number if the constitution has been published, the details of chemical constitution being given in Volume 4. A useful distinction which has practical significance can be made between those pigments which contain no salt-forming groups and those which consist of heavy metal salts of anionic dyes or high molecular weight acid salts of cationic dyes. Therfore when a C.I. Constitution Number is not available it is indicated under chemical class whether the item is a pigment *per se* or a salt.

All hue groups contain some important inorganic members accompanied, except for white pigments, by a much larger number of organic members. Summarising under hue groups Yellow, Orange and Red pigments are predominantly azo compounds but include a number of polycyclic compounds; the Blue and Green hues are dominated by phthalocyanines but also contain triarylmethanes and other compounds; and Violets are increasingly based upon dioxazines and triarylmethanes.

Practical Classification

From the practical point of view, pigments are conveniently divided into the following five groups (Ref. Oil and Colour Chemists' Association, *Paint Technology Manuals*, Part 6).

1. Organic Pigments

CONCENTRATED ORGANIC COLOURING MATTERS CONTAINING NO SALT FORMING GROUPS.

These include azo compounds (e.g. C.I. Pigment Red 3), vat dyes (e.g. C.I. Vat Blue 4), phthalocyanines (e.g. C.I. Pigment Blue 15), quinacridones (e.g. C.I. Pigment Red 122) and nitroso compounds (e.g. C.I. Pigment Green 8). They are full strength, i.e. contain no added diluent. Generally they are unaffected by alkali.

2. Toners

CONCENTRATED COLOURING MATTERS PRODUCED BY REACTION OF A WATER SOLUBLE DYE WITH AN APPROPRIATE PRECIPITANT.

They include azo compounds (e.g. C.I. Pigment Red 48, made as Ca, Ba, Mn and Sr salts) and the products of precipitation of Basic dyes from e.g. xanthene, triarylmethane and other groups with phosphomolybdic (PMA), phosphotungstomolybdic (PTMA) and other complex acids, tannic acid, copper ferrocyanide etc. (e.g. C.I. Pigment Red 81, phosphotungstomolybdic salt of C.I. Basic Red 3). They contain no diluent. Generally they exhibit some instability under alkaline conditions.

Note: The usage of the word Toner in the U.K. pigment manufacturing and using industries has changed. Formerly it was used to denote a "Full strength" as opposed to an "Extended" pigment (see 4, below) but as the use of full strength pigments has increased relatively to that of extended pigments the term has come to provide a convenient name for the chemical class described above.

In U.S.A. the former usage continues and the term "Toners" covers all full strength pigments.

3. Lakes

BROADLY SIMILAR TO TONERS IN TYPE BUT PRECIPITATED IN THE PRESENCE OF A SUBSTRATE SUCH AS ALUMINA, ALUMINA BLANC-FIXE ETC., THE SUBSTRATE BEING A NECESSARY AND INTEGRAL PART OF THE PRODUCT.

They include azo compounds (e.g. C.I. Pigment Red 60, lakes from C.I. Mordant Red 9), anthraquinonoid compounds of the mordant class (e.g. C.I. Pigment Red 83, lake of C.I. Mordant Red 11) or acid class. Because of the presence of substrate they tend to be tinctorially weaker than Organic Pigments or Toners and they have similar alkali sensitivity to the latter. Their importance as a class has steadily declined.

4. Extended Pigments

PIGMENTS OR TONERS (RARELY LAKES) DILUTED WITH AN EXTENDER (E.G. ALUMINA, ALUMINA BLANC-FIXE, CALCIUM CARBONATE) WHICH IS NOT AN INTEGRAL PART OF THE PIGMENT.

Note. Such extended pigments have been and often are described as "Reduced Pigments" but the term "Reduced" is preferably confined to the products of dilution with white pigment.

5. Inorganic Pigments

COLOURED, INSOLUBLE COMPOUNDS OF MAINLY INORGANIC COMPOSITION.

These include elements (e.g. C.I. Pigment Blacks 6, 7), oxides (e.g. C.I. Pigment White 6), salts (e.g. C.I. Pigment Yellow 34) and complex salts (e.g. C.I. Pigment Blue 27). Whilst all hue groups contain some Inorganic pigments the C.I. Pigment Whites are exclusively inorganic.

From the point of view of usage the members of all the above five classes are equally pigments but with differing properties and corresponding application potentialities according to their class.

Relation of C.I. Pigments to other C.I. Usage Sections

Some pigments are closely related to or derived from commercial textile dyes in the C.I. Acid, Basic, Mordant or Vat usage sections. Where this is the case suitable cross references have been made. In addition to those pigments given C.I. Generic Names and reviewed in the following pages there are a number, consisting essentially of salts of water soluble textile dyes, which have a more limited use. A list of the textile dyes so used is given on page 3389. Corres-

ponding notes are given under "Non-Textile Usage" in the C.I. Acid or other usage section as appropriate. The selection of such salts for treatment as C.I. Pigments may seem arbitrary but in practice the information supplied by manufacturers has reflected almost complete unanimity as to which should be selected.

Attention is called to the C.I. Azoic dyes where some of the combinations described for production upon textile fibres have the same constitution as certain C.I. Pigments. Reference to these is made in the C.I. Azoic Coupling Component section.

Fastness and other Properties required in Pigments

Hue, as with all colouring matters, is a first consideration but must be accompanied by fastness properties appropriate to the particular use. The physical properties of crystalline form (which can influence many of the properties required in use), refractive index (influencing opacity in proportion to the difference from the refractive index of the medium), specific gravity, particle size, size distribution and solubility in various solvents have great importance as do the properties of fastness to light and heat. However, the fastness properties of a pigment vary with the media of incorporation whether the finished product is a surface coating or a mass coloured body. Thus while, in order to be technically acceptable, a pigment must have certain intrinsic physical properties what really determines its technical value is its fastness under the combined effects of the media of incorporation and of the external environment. Fastness to light and heat are conspicuous among the properties affected by the media.

Reactive chemicals such as acids, alkalis, sulphur dioxide or hydrogen sulphide may be present in, or produced in, the medium of use or present in the subsequent environment and for most applications therefore a completely inert pigment is the ideal. Few pigments achieve this ideal but for practical purposes the useful life of a pigment need be no more than that of the coating film or mass in which it is incorporated. The principle applies to all colouring matters but particularly to pigments with their great variety of applications and the facility often available for exercising special care in their use. These circumstances account for the fact that in some cases pigments are described as used for purposes for which they might seem inadequately fast.

Many pigments are available commercially in a variety of forms specifically suited to incorporation in the varied media to which they may be applied. Important among these are easily dispersible forms which may be made by modification of the physical condition of the pigment and/or by addition of a substantial amount of a carrier which aids dispersion in the chosen medium of application. The commercial names of such forms usually include symbols which indicate their special uses. Pigments for transparent effects and for mass coloration of man made fibres are examples of such special forms.

In order to provide a general picture of the chemical and physical properties of individual pigments, information has been tabulated under the fastness headings most widely used by manufacturers. Grades of fastness are expressed by qualitative terms or by numerical values following the customary "Excellent", "Very good", "Good", "Fair", "Poor" or corresponding 5–1 scales: that is 5 always indicates the highest degree of fastness except in the case of fastness to light which is expressed according to the 8–1 scale. The use of figures, when available, has been preferred because of the increasing use being made of them by many manufacturers, although it is not the general practice in the U.S.A. The standardising organisations of several countries have drawn up a number of test methods for pigments and these are increasingly the basis of the figures quoted by manufacturers in their literature. However, it must again be emphasised that the properties of pigments in their numerous applications are dependent on the conditions of use and the media of incorporation. Accordingly the information given in the following tables provides no more than a general indication of the potentialities of a pigment and an intending user should make confirmatory tests under his own conditions or seek a manufacturer's advice.

Figures given for fastness to light are in comparison with the 8 point Blue Scale (ISO R 105; BSS 1006; DIN 16525) now used by many manufacturers. In the U.S.A., however, the verbal scale "excellent", "very good", "good", "fair", "poor" is preferred to the number system. For the methods of test for the assessment of other fastness properties manufacturers' literature must be consulted, together with the published standard testing methods. (See Literature below).

Uses of Pigments

The uses of pigments are too numerous to allow a complete list to be given; some of the principal uses are grouped in the following paragraphs.

Decorative and protective coatings of all kinds, especially oil and resin based paints and including automotive finishes; emulsion paints; distempers, lime and other aqueous based paints. In addition to these long established uses there is an increasing use of pigment finishes on leather and on textiles.

Printing inks of all kinds, including inks for printing metal foils, and lacquers, including stoving lacquers.

Mass coloration of plastics such as rubber and synthetic polymers, especially poly(vinyl chloride) (PVC), nylons, polyolefins, polystyrene; phenol-formaldehyde (P–F), urea-formaldehyde (U–F) and melamine-formaldehyde moulding powders, acrylonitrile-butadiene-styrene resins (ABS); floorings such as linoleum.

Mass coloration of man made fibres such as nylons, polyacrylonitrile, polyesters and polyolefins; also from regenerated and chemically modified cellulose.

Paper coloration in the beater and by coating.

Coloration of cosmetics, detergents and soap, wax compositions, modelling clay, chalks, crayons, coloured pencils and artists' colours; carbon papers and typewriter ribbons.

Coloration, chiefly by inorganic pigments, of glass, ceramics and cement.

LITERATURE

Articles on the chemistry, properties and application of pigments appear in the following technical journals:
American Ink Maker, New York
British Ink Maker, London
Deutsche Farben–Zeitschrift, Stuttgart

Die Farbe, Göttingen
Farbe und Lack, Hanover
Farg och Lack, Copenhagen
Journal of the Oil and Colour Chemists Association, London
Journal of Paint Technology, Philadelphia
Journal of the Society of Dyers and Colourists, Bradford
Paint, Oil and Chemicals Review, Illinois
Peintures, Pigments, Vernis, Paris
Plastics and Polymers, Journal of the Plastics Institute, London
Plastics World (Denver, Colo., U.S.A., Plastics World)
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NOTES

C.I. Pigment Yellow 1—15

C.I. Pigment Yellow	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat	
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C	Stability °C
1	11680	Monoazo (Pigment)	Bright Yellow	3	3	2	1	2	2	2	V. good	256	Stable to 150 (20 min)
2	11730	Monoazo (Pigment)	Bright Yellow	—	—	—	Fair	—	—	Poor	Excellent	—	Good to 150
3	11710	Monoazo (Pigment)	Bright Greenish Yellow	1–2	1–2	1	1–2	1	1	1–2	7	258	Stable to 150 (20 min)
4	11665	Monoazo (Pigment)	Bright Greenish Yellow	Good	Good	—	Good	—	Fair	Fair	Good	217	Fair (not above 130)
5	11660	Monoazo (Pigment)	Bright Greenish Yellow	V. good	Fair	—	Fair	—	Fair	Fair	Good	206	Poor (sublimes)
6	11670	Monoazo (Pigment)	Bright Yellow	—	Poor	—	Poor	—	Poor	Poor	V. good	—	Poor (not above 130)
7	12780	Monoazo (Pigment)	Bright Reddish Yellow	—	V. good	—	V. good	—	V. good	V. good	Excellent	—	Good to 150
8	—	Organic (Pigment)	Yellow	—	Insol	—	Insol	—	Slight bleeding	Insol	V. good	—	Good to 150
9	11720	Monoazo (Pigment)	Yellow	—	Insol	—	—	—	Slight bleeding	—	V. good	235	Good
10	12710	Pyrazolone Azo (Pigment)	Reddish Yellow	Poor	Fair	—	V. good	—	Poor	Poor	V. good	228	Stable to 120 (becomes browner)
11	10325	Nitro	Bright Yellow	—	Poor	—	Poor	—	Poor	V. good	V. good	—	Poor (sublimes)
12	21090	Disazo (Pigment)	Yellow	4	3–4	3–4	4–5	2	2	2	4–5	317	150 (20 min) 4–5 (Greener)
13	21100	Disazo (Pigment)	Yellow	V. good	Fair	—	V. good	—	Fair	Fair	Good	344	V. good to 150 (rubber)
14	21095	Disazo (Pigment)	Yellow	Insol	V. good	—	V. good	Good	V. good	V. good	Good	336	V. good to 150
15	21220	Disazo (Pigment)	Greenish Yellow	—	—	—	V. good	—	—	Poor	Good	—	V. good to 150

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Yellow
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Insol	4–5	5	5	5	4–5	—	5	Paints and printing inks, emulsion paints and distempers; paper coating and wallpaper; mass coloration of viscose and in linoleum. Use in lacquers limited by solvent solubility and in rubber although its solubility is a disadvantage. Also used in textile printing, leather finishes and in P/F, U/F and vinyl plastics although some migration occurs on heating	1
			Standard BS 3599/1–5: 1963 (Arylamide Yellow G)						
Insol	Unalt	Unalt	V.good	Good	—	—	None	Closely similar in usage to C.I. Pigment Yellow 1	2
Insol	4–5	5	3–4	4	3–4	—	5	Closely similar in usage to C.I. Pigment Yellow 1. Unsuitable in rubber because of rubber solubility	3
			Standard BS 3599/1–5: 1963 (Arylamide Yellow 10G)						
Insol	Good (redder)	V.good	V.good	V.good	—	—	Slight	Printing inks. Some use in paints, lacquers and leather finishes, alkyd resin enamels, textile printing and rubber. Poor fastness to lime and sensitive to heat treatments	4
Insol	4–5	5	5	4	2–4	Some on heating	4	Printing inks. Limited use in lacquers, leather finishes, emulsion paints; amino-, pheno- and protein plastics, rubber and PVC	5
Insol	Unalt	V.good	V.good	Poor	—	—	Slight	Printing inks. Limited use in lacquers, because of solvent sensitivity; amino, cellulose acetate polystyrene and polyethylene plastics and rubber	6
Insol	Unalt	Unalt	V.good	V.good	—	—	None	Paints, printing inks, NC and resin lacquers; paper staining, tin printing, plastics	7
Insol	Unalt	Unalt	Insol	Insol	—	—	Slight	Printing inks	8
Insol	V.good	V.good	Insol	Insol	—	—	None	Paints and printing inks, emulsion paints and distempers and generally similar to C.I. Pigment Yellow 1	9
Insol	Unalt	Unalt	V.good	V.good	—	—	Slight	Printing inks of all types, emulsion paints and distempers; paper coating, urea and styrene resins	10
Insol	V.good	V.good	Poor	V.good	—	—	None	Wallpapers, lime and distemper colours	11
Insol	4–5	5	5	5	4–5	—	4–5	Printing inks and lacquers giving good heat resistance, high tinctorial strength and high transparency; stoving lacquers and inks for wrappers, tinplate printing and wallpaper. In rubber, PVC, U/F and P/F resins as fastness to rubber curing and to solvents is superior to that of C.I. Pigment Yellow 1. Paper, textile printing, linoleum	12
			Standard BS 3599/6–15: 1964						
Insol	V.good	Unalt	V.good	V.good	—	—	None	Rubber and U/F, vinyl and polystyrene plastics. Also printing inks, paints and distempers	13
Insol	V.good	Unalt	V.good	V.good	V.good	—	None	Rubber and U/F, P/F, PVC, polystyrene and vinyl plastics and printing inks and on textiles. Occasionally paints and paper	14
Insol	Unalt	Unalt	V.good	V.good	—	—	None	Rubber	15

C.I. Pigment Yellow 16—31:1

C.I. Pigment Yellow	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
16	20040	Disazo (Pigment)	Bright Greenish Yellow	—	—	—	V. good	—	—	Poor	V. good	325 / V. good to 160
17	21105	Disazo (Pigment)	Bright Greenish Yellow	Good	3	—	Good	3	1–2	3	Good	— / Stable to 150 (30 min)
18	49005:1	Thiazol (PTMA* salt)	Bright Greenish Yellow→ Bright Yellow	—	Poor	—	Poor	—	Poor	Insol	Good	— / Darkens above 150
19	—	Azo (Pigment)	Yellow	This C.I. Generic Name is discontinued. Pigments listed under it now appear under C.I.								
20	—	Disazo	Yellow	—	V. good	—	Insol	—	V. good	V. good	V. good	— / Excellent
21	—	Organic (Pigment)	Bright Greenish Yellow	—	V. good	—	Insol	—	V. good	V. good	Good	— / —
22	—	—	—	This C.I. Generic Name is discontinued								
23	60520	Anthraquinone (Pigment)	Bright Greenish Yellow	—	—	—	V. good	—	V. good	Fair	V. good	— / —
24	70600	Anthraquinone (Pigment)	Reddish Yellow	—	V. good	—	Insol	Good	V. good	V. good	Excellent (full strength) Good (tint)	— / Darkens Good to 260
25	—	Organic (Pigment)	Greenish Yellow	—	—	—	—	—	Fair–good	—	Good–very good	— / Stable to 140
26	—	Organic (Pigment)	Greenish Yellow	Moderate fastness to solvents							Excellent	— / Stable to 120–140
27	—	Organic	Reddish Yellow (NC lacquer)	Very good fastness to solvents							V. good (Full strength)	— / Stable to 200
28	—	Organic (Pigment)	Dull Yellow	—	Good	—	Good	—	Good	V. good	Good	— / Excellent
29	—	Azo (Pigment)	Bright Yellow	—	—	—	—	—	—	Insol	Good	— / Good
30	77592	Inorganic	Greenish Yellow→ Yellow	—	—	—	Insol	—	—	—	—	— / —
31	77103	Inorganic	Dull Greenish Yellow	Insoluble in organic solvents							Excellent	— / V. good to 205
31:1	77106	Inorganic	Dull Greenish Yellow	Similar properties to C.I. Pigment Yellow 31								

 *Phosphotungstomolybdic acid

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Yellow
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Insol	Unalt	Unalt	V.good	V.good	—	—	None	Lacquers, printing inks, plastics, PVC	16
4	V.good	Unalt	4–5	5	1	—	None	Printing inks of high transparency	17
Insol	Poor	V.good	V.good	V.good	—	—	Severe	Printing inks for all purposes including metal foil and tin plate. Also paper colouring and coating The parent dye is C.I. Basic Yellow 1	18
Pigment Yellow 1									19
Insol	Unalt	Unalt	V.good	V.good	—	None	—	PVC, U/F and polystyrene plastics and rubber	20
Insol	Unalt	Unalt	Insol	Insol	—	—	—	Mass coloration of viscose rayon	21
									22
Insol	Poor	Unalt	—	—	—	—	—	Lacquers and printing inks; occasionally in plastics and oil paints	23
Insol	Unalt	Unalt	Insol	Good	—	—	None	Paints, printing inks, vinyl and polyolefin plastics **Textiles:** C.I. Vat Yellow 1	24
V.good	V.good	V.good	V.good	—	—	—	—	Printing inks; NC, resin and oil lacquers; paper. Transparent colouration of cellulose acetate, injection moulding powders and polystyrene	25
V.good	Good	Good	Fair–good	—	—	—	—	NC, resin and oil lacquers, printing inks, paper	26
V.good	Good	Good	V.good	—	—	—	—	NC lacquers, synthetic resins, stoving lacquers; occasionally in plastics and rubber	27
Insol	Unalt	Unalt	V.good	V.good	—	—	None	Paints, printing inks and lacquers; rubber, PVC, plastics	28
Insol	Unalt	—	—	—	—	—	—	Rubber and occasionally plastics and vinyls	29
Partly soluble	Insol	Partly soluble	—	—	—	—	—	Artists' oil colours. Now seldom used **Literature**: *Wagner*, 180	30
Insol	V.good	Poor	Insol	Insol	—	—	None	Anticorrosion jointing pastes to prevent electrochemical corrosion at junctions of dissimilar metals. Also artists' colours and in glass and porcelain Tinctorial power very low **Literature**: *BIOS* 1402, 134 Barium chromate was first made by Vauquelin in 1809 **Standard**: DTD369A:1939	31
—	—	—	—	—	—	—	—	Small use in similar manner to C.I. Pigment Yellow 31	31:1

C.I. Pigment Yellow	C.I. Constitution No.	Chemical Class	Hue	FASTNESS									
				ORGANIC SOLVENTS							Light	Heat	
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C	Stability °C
32	77839	Inorganic	—	—	—	—	—	—	—	—	—	—	—
33	77223	Inorganic	—	—	—	—	—	—	—	—	—	—	—
34	77600 77603	Inorganic	Greenish Yellow→ Yellow	Insoluble in organic solvents							V. good but darkens	—	Stable to 120 (Primrose) 150 (Lemon) 140 (Middle)
				C.I. Pigment Yellow 34 provides with C.I. Pigment Orange 21, C.I. Pigment Red 103 and C.I. Pigment Red 104 a range of hues from greenish yellow to red in pigments of closely similar chemical constitution, fastness properties and usage							Chromes made from lead nitrate generally darken less on exposure than do those from lead acetate		
35	77117	Inorganic	—	—	—	—	—	—	—	—	—	—	—
36	77955	Inorganic	Bright Greenish Yellow	Insoluble in organic solvents							Excellent	—	Stable to 120 (Stoving medium)
36:1	77956	Inorganic	Dull Reddish Yellow	Insoluble in organic solvents							V.good	—	Stable to 170 (Stoving medium)
37	77199	Inorganic	Bright Yellow→ Reddish Yellow	Insoluble in organic solvents							Excellent	—	Excellent (but sensitive to acid decomposition products of medium if present)

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Yellow
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
—	—	—	—	—	—	—	—	Corrosion inhibitor for stoving primers Now very little used as a pigment (lacks brightness, though brighter than C.I. Pigment Yellow 31, and covering power)	32
—	—	—	—	—	—	—	—	Now little used on account of lack of brightness and covering power **Standard:** DTD 495	33
Insol	Poor (reddens and bleeds slightly)	Poor (reddens and bleeds slightly)	Insol	Insol	—	—	Slight	**Chrome Yellow.** Very widely used in paints and printing inks having the advantage of good resistance to weather (though the hue darkens). Also for paper, linoleum, vinyl and cellulose acetate plastics, leather finishes, artists' colours and textile printing. The hue is darkened by H_2S	34

Literature
FIAT 811
Jaeger and Germs, *Z. anorg. alg. Chem.*, **119** (1921), 162
Wagner, *Z. angew. Chem.*, **44** (1931), 665
Res. Assoc. Brit. Paint, Colour and Varnish Manufacturers. Technical Papers 1926–31, p.430
Wagner, Zipfel, Heintz and Haug, *Farben-Z.*, **38** (1932), 932, 960
Clay and Watson, *J. Oil Col. Chem. Assocn.*, **27** (1944), 3; **31** (1948), 418; **38** (1955), 167
The lead chromates were first made by Vauquelin in 1809

Standards
USA National Bureau of Standards, Standard Samples Nos. 319–321
BS 282:1953
USA ASAK 27:1; ASTM D 211–47; ASTM D 126 (analysis); ASTM D-211-63 T
Argentina IRAM 1046
Australia K 74
Holland N 884, NEN 1964 2142 Pigments (Methods of test for lead titanate)
India IS 50 S. Africa SABS 64
Poland PN C 260 Uruguay UNIT 85

Fastness properties very similar to those of C.I. Pigment Yellow 37								Rubber, printing inks and wallpaper especially in pale tones; better dispersion in rubber than C.I. Pigment Yellow 37 **Literature:** Curtis and Wright, *J. Oil Col. Chem. Assocn.*, **37** (1954), 30 **Standard:** USA Fed.Spec. TT-C-83	35
Fair	Good	Poor	Insol	Insol	—	—	Moderate	**Zinc Yellow.** There are two types of Zinc Yellow. Type I is C.I. Pigment Yellow 36; Type II (Basic Zinc Yellow) is C.I. Pigment Yellow 36:1. C.I. Pigment Yellow 36 is used in priming paints as a corrosion inhibitor and where there is exposure to atmospheric sulphur gases, including admixtures with Prussian Blue (C.I. Pigment Blue 27) or Ultramarine (C.I. Pigment Blue 29) as "Zinc Greens." Also in lacquers, alkyd resin enamels, plastics, linoleum and artists' colours. C.I. Pigment Yellow 36:1 is used in vinyl wash primers, as corrosion inhibitor. Occasionally in admixture with C.I. Pigment Yellow 36 and C.I. Pigment Green 17	36
V.good	—	Poor	—	Insol	—	—	—		36:1

Literature
BIOS 1402, 126
Wagner and Haug, *Farben.Z.*, **38** (1933), 988
Garnor and Veal, *JCS* (1935), 1487
Britton and Evans, *JSCI*, **55** (1936), 337T
Brizzoloria *et al.*, *Ind. Eng. Chem.*, **29** (1937), 656

Standards BS 389:1953
ASTM D 444–51, D 478-49; USA Fed.Spec. TT-Z-415(1); TT-P-465
Argentine IRAM 1083
Germany DIN 55 902
Holland U NEN 1962: 1940; NEN 1964: 1941
India IS 51
BS 303:1938 Zinc Chrome Greens

Insol	Unalt	Poor (soluble)	Insol	Insol	—	—	None	**Cadmium Yellow.** Somewhat expensive and therefore used mainly in high quality work. Not affected by H_2S. Paints, alkyd resin enamels, lacquers, emulsion paints, rubber and occasionally in printing inks, paper, plastics and vinyl products. Artists' colours, ceramics and glass. Some use in fluorescent paints, particularly in association with C.I. Pigment White 7	37

Literature
BIOS 1402, 176
FIAT 814, 39
Dudley and Ward, *J. Oil Col. Chem. Assocn.*, **10** (1927), 4, 40
Curtes and Wright, *J. Oil Col. Chem. Assocn.*, **37** (1954), 26

Standards
BS 1316:1946 (in fluorescent paints)

C.I. Pigment Yellow	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
38	77878	Inorganic	Metallic Yellow	Insoluble in organic solvents							—	— / —
39	77085 77086	Inorganic	Yellow	Insoluble in organic solvents							—	— / —
40	77357	Inorganic	Yellow	Insoluble in organic solvents							Excellent	— / Poor (becomes brown)
41	77588 77589	Inorganic	Bright Greenish Yellow→ Reddish Yellow	Insoluble in organic solvents							Excellent	— / Excellent
42 43	77492	Inorganic	Dull Reddish Yellow→ Yellowish Brown Also cream and ivory tints	Insoluble in organic solvents							Permanent	— / Fair (reddens above 100)
44	77188	Inorganic	Bright Yellow	Insoluble in organic solvents							—	— / —

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Yellow
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Insol	NaOH Soluble	Insol	—	—	—	—	—	**Mosaic Gold.** Formerly much used in albumin, varnish or oil medium for gilding wood, plaster of paris and metals affected by an acid atmosphere. Now largely replaced by metallic bronze pigments. (See C.I. Pigment Metal 2)	38
Insol	—	—	—	—	—	—	—	**Kings Yellow.** The minerals Orpiment and Realgar have been used from the earliest times as pigments and Orpiment for the dehairing of skins in tanning. Arsenic trisulphide was used in calico printing *ca* 1840. In so far as the arsenic sulphides are still used the minerals have been replaced by synthetic products. The very poisonous character is a serious defect	39
Note. King's Yellow (or Old King's Yellow) was originally arsenic sulphide but now a mixture of cadmium sulphide (C.I. Pigment Yellow 37) and zinc oxide (C.I. Pigment White 4) may be offered under that name									
V.good	V.good (darkens)	V.good (darkens)	V.good	Insol	—	—	Slight	Essentially in artists' oil colours (Aureolin, Cobalt Yellow, Fischer's Salt, Indian Yellow), being non-toxic and of high light fastness. Used in painting glass and porcelain and occasionally in plastics and paper. Poor opacity and staining power limit possible use in paints and lacquers	40
Insol	Insol	Decomposed	—	—	—	—	—	Primarily in ceramics and glass and also as an artists' colour in oil and fresco painting (Naples Yellow, Giallolino, Antimony Yellow, Merimee's Yellow, Jaune Brilliant). Too expensive for general use in paints **Literature** *BIOS* 1402, 165 *Wagner*, 190	41
Note. Now largely replaced by a mixture of cadmium sulphide (C.I. Pigment Yellow 37), zinc oxide (C.I. Pigment White 4) and Venetian Red (C.I. Pigment Red 101) as Naples Yellow is liable to turn grey in presence of iron and zinc pigments									
Insol	Unalt	Poor (dissolves)	Insol	Insol	—	—	None	C.I. Pigment Yellow 42, precipitated iron oxide. C.I. Pigment Yellow 43, natural iron oxide **Ochre.** Wide range of uses because of general inertness, fastness to solvents and economy. Much used in paints, alkyd resin enamels, emulsion paint, cement and concrete. Also in linoleum, paper (including wallpaper), textile printing and in rubber, plastics and vinyl products Textiles: Produced on cellulosic fibre with chromic oxide as Mineral Khaki	42 43
Literature *BIOS* 1144, 1272 *FIAT* 814 Storey, *J. Oil Col. Chem. Assocn.*, **15** (1932), 33 Smith, *J. Oil Col. Chem. Assocn.*, **20** (1937), 307 Voight, *Farben, Lacke, Anstrichstoffe*, **2** (1948), 70 Race, Rowe and Speakman, *JSDC*, **57** (1941), 213, 257 (Mineral Khaki)								**Standards** USA National Bureau of Standards, Standard Samples Nos. 314–317 *Yellow Ochres* BS 337:1952; BS 3981:1966 USA Fed.Spec. TT-0-121 and TT-0-1216 France T 31-002 India IS 47 *Manufactured hydrated Oxides of Iron* BS 851:1952 USA Fed.Spec. TT-P-216b *Yellow Hydroxide of Iron Pigment for Cement* BS 1014:91 USA Fed.Spec. TT-Y-216(2)	
—	—	—	—	—	—	—	—	**Cadmium Chrome Yellow.** Bright yellow pigment but expensive and rarely used **Literature**: *Wagner*, 131	44

C.I. Pigment Yellow 45—55

C.I. Pigment Yellow	C.I. Constitution No.	Chemical Class	Hue	FASTNESS									
				ORGANIC SOLVENTS							Light	Heat	
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C	Stability °C
45	77505	Inorganic	Yellow, Brown and Black	Insoluble in organic solvents							Good	—	—
46	77577	Inorganic	—	—	—	—	—	—	—	—	—	—	—
47	77645	Inorganic	Pale Yellow	—	—	—	—	—	—	—	—	—	—
48	77610	Inorganic	Greenish Yellow	—	—	—	—	—	—	—	—	—	
49	11765	Monoazo (Pigment)	Bright Yellow	—	—	—	—	—	—	—	V. good	—	—
50	—	Monoazo (Calcium salt)	Bright Reddish Yellow	—	—	—	—	—	—	—	V. good	—	Polythene (240) little weaker Cellulose acetate (220) little duller Poly-styrene (280) little weaker
51	—	Disazo	Bright Reddish Yellow	V. good	Good	—	Good	—	—	Fair	Good (Rubber)	—	—
52	—	—	—	This C.I. Generic Name is discontinued									
53	77788	Inorganic	Greenish Yellow	Insol	—	—	Insol	—	Insol	Insol	Excellent (full shade and tints)	—	Stable to 950
54	—	—	—	This C.I. Generic Name is discontinued									
55	21096	Disazo (Pigment)	Reddish Yellow	Insol	V.good	—	V.good	—	V.good	Fair	V.Good	—	Stable to 150 does not sublime

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Yellow
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
—	—	—	High opacity in oil		—	—	—	**Siderin Yellow.** Used principally in glass, enamel and ceramic industries. Dries to cement like film in sodium silicate. In mixture with blues gives good greens	45
—	—	—	—	—	—	—	—	**Litharge, Massicot.** Glass manufacture, enamelling and formerly in paints for undercoats. Also for manufacture of C.I. Pigment Red 105 **Standards** (Litharge) India IS 58 Roumania STAS 100	46
			Chemically inert					**Lead Titanate.** Oil paints, especially as an extender for priming paints for wood and for anti-corrosion finishing coats for steel. Excellent exterior durability and protective properties. Much used in Holland for ships paints **Literature** Robertson, *Ind. Eng. Chem.*, **28** (1936), 216 **Standard** Holland V1337	47
—	—	—	—	—	—	—	—	**Lead Cyanamide.** Rust inhibitive paints for ferrous surfaces either alone or with inert pigments, e.g. red iron oxide. Reacts with acid gases and fatty acids and takes up the acid decomposition products of drying oils forming lead soaps in much the same manner as red lead **Literature** *FIAT* 681, 51 de Roever, *Metall*, **7** (1953), 876	48
—	—	—	—	—	—	—	—	Mass coloration of viscose fibre	49
—	—	—	—	—	—	—	—	Plastic moulding materials, especially polythene, cellulose acetate and nitrate, polystyrene and urea-formaldehyde Very good transparency	50
Insol	Unalt	Unalt	—	Fair	—	—	—	Rubber	51
									52
Insol	Unalt	Unalt	Insol	Excellent	—	None	None	Paints and printing inks	53
									54
Insol	V.good	V.good	Insol	—	—	Slight	Slight	Printing inks, especially in steam-set inks to be given after-waxing treatment, e.g. food wrappers; also textile printing	55

C.I. Pigment Yellow 56—72

C.I. Pigment Yellow	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
56	—	Azo	Yellow	V. good	V. good	—	V. good	—	Fair	V. good	—	— / Stable to 300 (Lithographic varnish)
57	—	—	—	This C.I. Generic Name is discontinued. Pigments formerly listed under it now appear								
58	—	Azo	Yellow	V. good	V. good	—	V. good	—	Fair	V. good	—	— / Stable to 300 (Lithographic varnish)
59	—	—	—	This C.I. Generic Name is discontinued								
60	12705	Monoazo (Pigment)	Bright Reddish Yellow	—	—	—	Fair	—	Poor	—	Excellent (full strength) Fair (tints)	— / Poor
61	—	Monoazo (Salt of Acid dye)	Greenish Yellow	—	—	—	—	—	—	Insol	6–7 (print) 7–8 (on viscose)	— / Very good to 180
62	—	Azo (Barium Salt of Acid dye)	Yellow	—	—	—	—	—	—	—	7–8 (print or in viscose)	— / Stable to 180
63	21091	Disazo	Greenish Yellow	—	—	—	—	—	—	V. good	—	— /
64				This C.I. Generic Name is discontinued								
65	11740	Monoazo (Pigment)	Bright Reddish Yellow	Fair	V. good	—	V. good	—	Poor	Poor	Excellent (full strength) Good (tints)	— / Considerable shade change 150 (30 min lithographic varnish)
66				These C.I. Generic Names are discontinued								
67												
68												
69												
70												
71												
72	—	Organic (Pigment)	Greenish Yellow	—	—	—	—	—	—	—	V. good (viscose)	— / —

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Yellow
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Insol	Insol	V. good	Insol	V. good	—	—	Slight	Printing inks, artists' colours, textile printing, paints, lacquers, leather finishes	56
under C.I. Pigment Yellow 55									57
Insol	Insol	V. good	Insol	V. good	—	—	Slight	Printing inks, artists' colours, textile printing, paints, lacquers, leather finishes	58
									59
Excellent	Good	Good	Good	—	—	—	—	Paints, lacquers, printing inks, stains; also plastics, rubber, paper, floor coverings and synthetic fibres	60
Insol	Unalt	Unalt	—	—	—	None	—	Rubber and PVC; pigment printing of cellulosic fibres and mass coloration of viscose and cuprammonium fibres. Hue and fastness to light unaltered by UF anticrease finish	61
Insol	Unalt	Unalt	—	—	—	None	—	Rubber and PVC; pigment printing of cellulosic fibres and mass colouration of viscose and cuprammonium fibres. Hue and fastness to light unaltered by UF anticrease finish	62
Insol	—	—	—	—	—	—	—	Generally similar to C.I. Pigment Yellow 12	63
									64
Fair	Excellent	Excellent	Poor	—	—	Bleeds	None	In oil media, especially in latex paints for exterior use	65
									66
									67
									68
									69
									70
									71
Insol	Insol	—	—	—	—	—	None	Mass coloration of viscose fibre	72

C.I. Pigment Yellow	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
73	11738	Monoazo	Bright Yellow	Fair	V.Good	—	V.good	—	Poor	Poor	Excellent	264–268 / Considerable change and tendency to sublime (lithographic varnish 150)
74	11741	Monoazo	Bright Yellow	V.good	Fair	—	Fair	—	Poor	Poor	V.good	293 (Technical) / Considerable change and tendency to sublime (lithographic varnish 150)
75	11770	Monoazo	Reddish Yellow	V.good	Fair	Fair	Fair	Fair	Fair	Fair	V.good	— / Slightly affected and tendency to sublime (baking enamel 150)
76	—	—	—	This C.I. Generic Name is discontinued. Pigments listed under it now appear under								
77	20045	Disazo	Bright Yellow	Insol	—	—	Insol	—	—	*Benzene* Poor	Good (linseed oil)	— / Stable to 150
78				These C.I. Generic Names are discontinued								
79												
80	—	Disazo	Yellow	Insol	V.good	—	Insol	—	V.good	Fair	Good (stoving enamel)	— / Stable to 180 (stoving enamel) does not sublime
81	—	Azo	Bright Greenish Yellow	—	—	—	V.good	—	Insol	*Benzene* Good	V.good	— / Stable to 180
82	—	Azo	Greenish Yellow	V.good	—	—	Good	—	Fair	—	V.good	— / Stable to 150 (lacquer)
83	—	Disazo	Reddish Yellow	Insol	—	—	V.good	—	—	*Toluene* Good	V.good	— / Stable to 200
84	—	Disazo	Yellow	V.good	—	—	—	—	Poor	—	—	— / —
85	—	Monoazo (Barium salt of Acid dye)	Yellow	—	—	—	—	—	—	—	V.good (PVC)	— / Excellent

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Yellow
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Insol	Excellent	V.good	Poor	—	Poor	Bleeds	—	Industrial and architectural paints, printing ink and rubber	73
Insol	V.good	V.good	V.good	V.good	—	—	Slight	Paints and printing inks	74
Insol	V.good (darkens slightly)	Insol	V.good	V.good	—	—	Slight	Paints, printing inks, artists' colours Stoving enamels in full strengths only	75
C.I. Pigment Yellow 55									76
Insol	Unalt	Unalt	Insol	—	—	Slight	None	In oil media, especially for transparent lacquers	77
									78
									79
Insol	V.good	V.good	Insol	—	—	Bleeds	None	Air-drying and stoving enamels, printing inks, PVC flooring and rubber	80
Insol	Unalt	Unalt	—	—	—	—	None	Paints, lacquers and printing inks; emulsion paints and distempers	81
Insol	—	—	—	Good	—	—	Fair	Mainly printing inks; some use in paints and lacquers	82
Insol	Good	—	Insol	Insol	—	—	Good	Mainly printing inks; some use in paints and lacquers	83
Insol	V.good	V.good	V.good	—	—	—	—	Printing inks and in resin bonded pigment printing of textiles. The chemical constitution is 3,3′-dichlorobenzidine⇉ mixed acetoacetarylamides (2 mol.)	84
—	V.good	V.good	—	—	—	None	—	PVC and polyethylene	85

C.I. Pigment Yellow	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
86	—	Monoazo (Barium salt of Acid dye)	Yellow→ Reddish Yellow	—	—	—	—	—	—	—	V.good (PVC)	— / Excellent
87	—	Disazo (Pigment)	Reddish Yellow	—	V.good	—	V.good	—	Good	Good	V.good	— / V.good
88	—	Disazo (Pigment)	Yellow	—	V.good	—	V.good	—	V.good	V.good	V.good	— / V.good
89	—	Disazo (Pigment)	Yellow	—	V.good	—	V.good	—	Good	Good	Good	— / V.good
90	—	Disazo (Pigment)	Reddish Yellow	—	V.good	—	V.good	—	Good	Good	Fair	— / V.good
91	—	Disazo	Yellow	—	V.good	—	V.good	—	V.good	V.good	Good	— / V.good
92	—	—	—	This C.I. Generic Name is discontinued								
93	—	Disazo	Yellow	Insol	V.good	—	Insol	—	Insol	Insol	Excellent (PVC)	— / Stable to 180 (PVC)
94	—	Disazo	Greenish Yellow	Insol	Insol	—	Insol	—	Insol	Insol	Excellent (PVC)	— / Stable to 180 (PVC)
95	—	Disazo	Reddish Yellow	Insol	V.good	—	Insol	—	Insol	Insol	Excellent (PVC)	— / Stable to 180 (PVC)
96	—	—	—	This C.I. Generic Name is discontinued								
97	—	Monoazo	Bright Yellow	5	—	4	4–5	3	Excellent	*Toluene* 3–4	7 (printing ink) 8 (stoving lacquer)	— / Stable to 200 (U/F)
98	—	Monoazo	Bright Greenish Yellow	4–5	—	3–4	4–5	3–4	—	*Toluene* 3	7	— / Stable to 180 (U/F)
99	—	Anthraquinone	Reddish Yellow	5	—	5	5	—	—	*Toluene* 5	8 (full strength) 7–8 ($\frac{1}{10}$ strength NC lacquer)	— / Stable to 180
100	19140:1	Monoazo (Aluminium salt)	Greenish Yellow	—	—	—	—	—	—	—	—	— / —
101	48052	Azomethine	Bright Yellow	Insol	Insol	Insol	Insol	Insol	—	Bleeds slightly	Good	— / Good
102	—	Monoazo	Reddish Yellow	—	—	—	—	—	—	—	—	— / —
103	—	Monoazo (Calcium salt)	Yellow	—	—	—	2	—	—	*Toluene* 3	5–6	— / Stable to 150

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Yellow
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
—	V.good	V.good	—	—	—	None	—	PVC and polyethylene	86
Insol	V.good	Unalt	V.good	—	—	—	—	Printing inks, emulsion paints, textile printing, rubber and UF resins	87
Insol	V.good	Unalt	V.good	—	—	—	None	Printing inks of high transparency	88
Insol	V.good	V.good	V.good	—	—	—	—	Printing inks of high transparency	89
Insol	V.good	V.good	V.good	—	—	—	—	Printing inks and emulsion paints	90
Insol	V.good	V.good	V.good	—	—	—	None	Rubber, PVC and U/F resins; also in printing inks	91
									92
Insol	Insol	Insol	Insol	—	—	None	None	Mass coloration of PVC and polyolefines; also in paints and printing inks	93
Insol	Insol	Insol	Insol	—	—	None	None	Mass coloration of PVC and polyolefines; also in paints, printing inks, stoving enamels and lacquers	94
Insol	Insol	Insol	Insol	—	—	None	None	Mass coloration of PVC and polyolefines; also in paints, printing inks, stoving enamels and lacquers	95
									96
5	Unalt	Unalt	4	—	3–4	—	None	Printing inks, NC and stoving lacquers	97
5	Unalt	Unalt	—	—	—	—	None	Printing inks	98
5	V.good	V.good	5	—	5	Good	—	Paints, printing inks, lacquers (including stoving lacquers), amino and cellulose acetate plastics	99
—	—	—	—	—	—	—	—	Cosmetics The parent dye is C.I. Acid Yellow 23	100
Insol	Fair	—	—	—	—	—	—	Paints, lacquers, inks, textile printing, especially with UV transparent media Hue under UV and daylight almost identical	101
									102
4–5	4–5	5	5	—	4	—	—	Printing inks and lacquers	103

C.I. Pigment Yellow 104—122

C.I. Pigment Yellow	C.I. Constitution No.	Chemical Class	Hue	FASTNESS									
				ORGANIC SOLVENTS							Light	Heat	
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C	Stability °C
104	15985:1	Monoazo (Aluminium salt)	Yellow	—	—	—	—	—	—	—	—	—	—
105	—	Monoazo	Bright Greenish Yellow	—	4	3–4	4–5	3	3	3–4	7	—	Stable to 150 (20 min)
106	—	Disazo	Greenish Yellow	5	—	3–4	4–5	3–4	5	—	4–6	—	Good to 140
107	—	Monoazo	Reddish Yellow	3–4	4	—	—	—	3	*Toluene* 3–4	6–7	—	Stable to 180
108	68420	Anthraquinone	Yellow	Good	—	—	Good	—	Good	Good	Excellent (full strength) Good (tint)	—	—
109	—	Isoindolinone	Greenish Yellow	—	—	—	—	—	—	—	7–8	—	5
110	—	Isoindolinone	Reddish Yellow	—	—	—	—	—	—	—	8	—	5
111	—	Monoazo	Greenish Yellow	—	—	—	5	—	4	—	6 (25%) 4–5 (15%) (printing ink)	—	4
112	This C.I. Generic Name is discontinued. Pigments formerly listed under it now												
113	—	Disazo	Greenish Yellow	—	—	—	—	—	—	Good	—	—	—
114	—	Disazo	Reddish Yellow	—	—	—	—	—	—	—	—	—	—
115	47005:1	Quinoline (Aluminium salt)	Bright Greenish Yellow	Poor	V. good	—	V. good	—	—	Poor	Fair (oil)	—	—
116	—	Monoazo	Reddish Yellow	—	—	—	No bleeding	—	—	*Toluene* No bleeding	7 (full strength)	—	Stable to 180 (15 min)
117	—	Azomethine (Copper complex)	Greenish Yellow	Insol	V. good	—	V. good	—	V. good	V. good	Excellent (alkyd-melamine-formaldehyde)	—	No sublimation
118	77894	Inorganic	Reddish Yellow	Insoluble in organic solvents							Excellent	—	Stable to 1000
119	77496	Inorganic	Yellow	Insoluble in organic solvents							Excellent	—	Stable to 600
120	—	Monoazo (Pigment)	Yellow	—	—	4	4	3–4	—	*Toluene* 4	8 (PVC)	—	Stable to 200 (5 min)
121	—	Disazo (Diarylide)	Yellow	Similar to C.I. Pigment Yellow 12							—	—	—
122	—	Disazo	Yellow	Excellent	V.good	V good	Excellent	V.good	—	*Toluene* Good	7	—	—

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Yellow
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
—	—	—	—	—	—	—	—	Cosmetics The parent dye is C.I. Food Yellow 3	104
5	5	5	5	5	5	—	5	Paints and printing inks	105
5	5	5	5	—	—	—	4–5	Printing inks (especially letterpress) Good fastness to dairy food products	106
5	5	5	5	—	5	—	—	High quality industrial finishes	107
Insol	Good	Good	—	Good	—	—	—	Paints, printing inks, vinyl plastics, synthetic fibres **Textiles** – See C.I. Vat Yellow 20	108
—	—	—	—	—	—	—	—	Paints of most types	109
—	—	—	—	—	—	—	—	Paints of most types	110
5	5	—	—	—	—	—	5	Printing inks	111
appear under C.I. Pigment Yellow 24									112
—	—	—	—	—	—	—	—	—	113
—	—	—	—	—	—	—	—	—	114
V. good	V. good	V. good	Poor	—	—	—	—	Cosmetics The parent dye is C.I. Acid Yellow 3	115
—	V. good	V. good	—	—	—	—	—	NC lacquers, stoving enamels, paper	116
Insol	Insol	Insol	Insol	Insol	—	Slight bleeding	None	Paints and lacquers	117
Insol	Excellent	Excellent	Insol	Insol	—	—	None	Paints, plastics. Can be used in greatly reduced tones	118
Insol	Excellent	Good	Insol	Insol	—	—	None	Lacquers, paints, plastics in full and reduced tones	119
—	—	—	—	—	—	—	—	Chiefly PVC; also polythene and polystyrene	120
								Chiefly in printing inks including polyamide, chlorinated rubber, vinyl, NC based inks	121
Excellent	Excellent	Excellent	—	—	—	—	—	Chiefly in gravure and flexo inks, especially inks for the packaging industry; also inks for foil printing	122

C.I. Pigment Orange 1—15

C.I. Pigment Orange	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
1	11725	Monoazo (Pigment)	Yellowish Orange	1	1–2	1–2	1–2	1–2	2	1	6	210 / Stable to 140
2	12060	Monoazo (Pigment)	Bright Orange	Poor	Poor	—	Poor	—	Poor	Poor	Good	212 / Very good to 150
3	12105	Monoazo (Pigment)	Reddish Orange	—	Fair	—	Fair	—	Poor	—	Good	— / Fair (becomes browner)
4	12459	Organic	Bright Reddish Orange	—	—	—	Insol	—	—	Soluble	V. good	— / Stable to 180
5	12075	Monoazo (Pigment)	Bright Reddish Orange	3	2	2	2	2	2	2	6–7	302 / Stable to 150 (30 min) 4–5
6	12730	Monoazo (Pigment)	Dull Reddish Orange	—	Poor	—	Poor	—	Poor	—	V. good	— / Very good to 150 Some sublimation
7	15530	Monoazo (Acid dye: Salts used as pigments)	Bright Reddish Orange	—	Fair	—	Fair	—	Fair	V. good	Fair–good	— / Fair
8	—	Organic	Orange	—	Poor	—	Poor	—	Poor	Poor	Excellent	— / Poor (darkens)
9	—	Azo (Pigment)	Bright Reddish Orange	V. good	—	—	Insol	—	Insol	Insol	Fair	— / Good
10	—	—	—	This C.I. Generic Name is discontinued All information is transferred to C.I. Pigment Orange 2								
11	—	—	—	This C.I. Generic Name is discontinued								
12	—	Organic	—	Fair to good							Excellent	— / Stable to 145
13	21110	Disazo (Pigment)	Reddish Orange	2	1–2	1	4	1–2	2	1	5 (Linseed oil) 4 (Printing ink)	332 / Stable to 150 (30 min)
14	21165	Disazo (Pigment)	Yellowish Orange	—	—	—	V. good	—	V. good	V. good	V. good	— / Stable to 150
15	21130	Disazo (Pigment)	Yellowish Orange	Poor	—	—	V. good	—	Poor	Poor	Fair	— / —

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Orange
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
4–5	5	4 (redder)	3	4	2	—	—	Printing inks, including inks for soap wrappers and wallpaper. Also in rubber, paper, plastics, bookcloth, linoleum	1
Insol	Unalt	Unalt	V.good	V.good	—	—	Slight	Paints, alkyd resin enamels, printing inks and emulsion paints. Also paper, leather finishes and textile printing. Limited use in lacquers	2
—	Unalt	Unalt	Fair	Fair	—	—	Some bleeding	Mainly paper coating. Some use in paints and occasionally printing inks or lacquers	3
V.good	V.good	V.good	V.good	—	—	—	—	Printing inks, lacquers and plastics; also in paper, paper coating and wallpaper	4
4	4–5	4–5	4–5	5	3–4	—	4–5	Paints and printing inks, emulsion paints, alkyd resin enamels and lacquers. Also for paper, bookcloth, linoleum, wax compositions, rubber, urea and styrene resins. Also in textile printing and cosmetics **Standard** BS 3599/4 C.I. Pigment Orange 5 (Dinitraniline Red)	5
Insol	Unalt	Unalt	Poor	Poor	—	—	None	Plastics and cast resins where the fastness to heat and solubility in organic solvents, resins and plasticisers are an advantage. Occasionally in emulsion paints	6
Fair	Good	Good	V.good	V.good	—	—	Slight	Paints and printing inks (including inks for tinplate printing). Also wallpaper, chalks and cosmetics	7
Insol	Unalt	Unalt	V.good	Poor	—	—	Slight	Paints, printing inks, emulsion paints and distempers, linoleum, cosmetics and leather finishes	8
Insol	Fair	Unalt	—	V.good	—	—	None	Textile printing and paper (beater and coating)	9
									10
									11
V.good	V.good	V.good	Good	—	—	—	—	Paints and printing inks, plastics, paper and wallpaper	12
4–5	3	4–5	5	—	4–5	—	5	Paints and printing inks for a wide variety of purposes, having notably high tinctorial strength; rubber, PVC, amino-, cellulose-, polystyrene plastics, paper, linoleum, leather cloth; mass dyeing of viscose	13
Insol	Unalt	Unalt	Insol	V.good	—	—	None	Rubber	14
Insol	Unalt	Unalt	—	V.good	—	—	—	Printing inks; occasionally in rubber	15

C.I. Pigment Orange	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
16	**21160**	Disazo (Pigment)	Bright Orange→ Reddish Orange	Insol	—	—	Insol	—	Poor	Poor	Fair	— / Fair
17	**15510:1**	Monoazo (Barium Salt of C.I. Acid Orange 7)	Bright Orange to Bright Reddish Orange	—	Good	—	Good	—	V. good	Good	Fair	— / Very good (to 150) Slightly browner
17:1	**15510:2**	Monoazo (Aluminium Salt)	—	—	—	—	—	—	—	—	—	— / —
18	**15970**	Monoazo (Barium Salt of C.I. Acid Orange 12	Bright Reddish Orange (Rubber)	—	V. good	—	V. good	—	V. good	V. good	Fair	— / Fair (darkens above 120)
19	**15990**	Monoazo (Barium Salt of Acid dye)	Bright Reddish Orange	—	V. good	—	V. good	—	V. good	V. good	Fair	— / Good to 140
20	**77199 77196**	Inorganic	Yellowish Orange→ Reddish Orange	Insoluble in organic solvents							Excellent	— / Excellent (but sensitive to acid decomposition products of medium if present)
21	**77601**	Inorganic	Yellowish Orange→ Reddish Orange	Insoluble in organic solvents							V. good	— / Stable to 150
21:1	***77601*** (similar)	Inorganic	Yellowish Orange→ Reddish Orange	Insoluble in organic solvents							V. good	— / Stable to 200
22	**12470**	Monoazo (Pigment)	Reddish Orange	This C.I. Generic Name is discontinued								
23	**77201**	Inorganic	Yellowish Orange→ Reddish Orange	Insoluble in organic solvents							Excellent	— / Stable to 260

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Orange
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Insol	Unalt	Unalt	—	Insol	—	—	None	Printing inks, rubber, plastics, vinyl products, paper, textile printing; occasionally paints, alkyd resin enamels, lacquers and emulsion paints	16
V.good	Poor	V.good	Insol	Insol	—	—	Bleeds	Printing inks, including inks for tinplate and bread wrapper printing; occasionally in rubber, urea resins, paints and alkyd resin enamels. Has bright hue and high tinctorial strength	17
—	—	—	—	—	—	—	—	Printing inks, cosmetics. Fastness properties similar to those of C.I. Pigment Orange 17 The parent dye is C.I. Acid Orange 7	17:1
Poor–fair	Good	V.good	V.good	V.good	—	—	Slight	Rubber, as a minium substitute. It is insoluble in rubber and has very good tinctorial strength. Also plastics, paper and rotogravure printing where it has good transparency **Literature**: I.G., *BP* 298364	18
Insol	Poor	V.good	V.good	V.good	—	—	Bleeds	Inks for intaglio and sheet metal printing; also rubber and sealing wax	19
Very closely similar to C.I. Pigment Yellow 37 **Standard** USA Fed.Spec. TT-C-80 [Cadmium red (Cadmium Lithopone) dry paint pigment]								**Cadmium Orange.** C.I. Pigment Orange 20 forms with C.I. Pigment Yellow 37 and C.I. Pigment Red 108 a range of hues from yellow to red in pigments of closely similar chemical constitution, fastness properties and usage	20
Insol	Good (slight bleeding)	Good (slight bleeding)	Insol	Insol	5	—	None	**Chrome Orange.** Very widely used in paints, alkyd resin enamels, printing inks and lacquers and occasionally in emulsion paints and distempers. Tinplate and wrapper printing, paper, vinyl products, rubber, plastics, linoleum, artists' colours; C.I. Pigment Orange 21 provides with C.I. Pigment Yellow 34, C.I. Pigment Reds 103 and 104 a range of hues from greenish yellow to red in pigments of closely similar chemical constitution, fastness properties and usage	21
Literature: as for C.I. Pigment Yellow 34 **Standards**: as for C.I. Pigment Yellow 34, also USA National Bureau of Standards, Standard Samples Nos. 322–333									
V.good	Good	Good	—	—	—	—	—	Similar to C.I. Pigment Orange 21 being produced on a silica base. Anti-corrosion priming paints and lacquers	21:1
									22
Insol	Unalt	Poor	Insol	Insol	—	—	None	**Mercury Cadmium Orange.** Paints, enamels, printing inks; plastics, vinyl products, rubber, paper and textile printing **Literature** L. J. Gagliano and J. E. Daly, *USP* 2878134 Johnson, Matthey & Co., *BP* 815328	23

C.I. Pigment Orange 24—42

C.I. Pigment Orange	C.I. Constitution No.	Chemical Class	Hue	FASTNESS									
				ORGANIC SOLVENTS							Light	Heat	
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C	Stability °C
24	12305	Monoazo (Pigment)	Orange	—	—	—	—	—	—	—	Good	—	V. good
25	—	Azo	Orange	V. good	V. good	—	V. good	Fair	Fair	V. good	—	—	—
26													
27				These C.I. Generic Names are discontinued									
28													
29				This C.I. Generic Name is discontinued All information is transferred to C.I. Pigment Orange 39									
30				This C.I. Generic Name is discontinued All information is transferred to C.I. Pigment Orange 34									
31	—	Disazo	Orange	Insol	Insol	—	Insol	—	V. good	V. good	Good	—	Stable to 150 (PVC)
32	—	Monoazo (Pigment)	Reddish Orange	—	—	—	Poor	—	Poor	Poor	V. good	—	V. good
33	—	Monoazo (Salt of Acid dye)	Bright Reddish Orange	—	—	—	V. good	—	V. good	V. good	Fair	—	Good
34	21115	Disazo	Bright Orange→ Reddish Orange	V. good	Good	—	V. good	V. good	Fair–good	Poor	6–7 (Alkyd resin) 5 (Lithographic varnish)	350	Stable to 175 U/F
35	—	Azo	Orange	Insol	—	—	Insol	—	Insol	V. good	V. good (Lithographic varnish)	—	Good
36	—	Monoazo (Pigment)	Orange	5	—	4–5	4–5	4	5	5	6–8 (depending upon media)	—	Good
37				This C.I. Generic Name is discontinued All information is transferred to C.I. Pigment Orange 34									
38	—	Monoazo	Reddish Orange	5	—	4	4	3	V. good	*Benzene* 4	4–7 (depending upon media)	—	Stable to 200
39	45370:2	Phthalein (Aluminium Salt)	Orange	Insol	V. good	V. good	V. good	—	—	V. good	Fair (oil)	—	—
40	59700	Anthraquinone	Yellowish Orange	—	—	—	—	—	—	—	—	—	—
41				This C.I. Generic Name is discontinued									
42	—	Isoindolinone	Orange	—	—	—	—	—	—	—	8	—	4

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Orange
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
V.good	—	—	—	V.good	—	—	—	Printing inks and textile printing	24
Insol	Insol	V.good	Insol	V.good	—	—	Slight	Mainly textile printing inks, paints, lacquers, leather finishes	25
									26
									27
									28
									29
									30
Insol	Unalt	Unalt	V.good	—	—	Slight	None	Mass coloration of PVC and polyethylene	31
Insol	Unalt	Unalt	Poor	—	—	—	None	Printing inks and emulsion paints	32
Insol	Poor	V.good	V.good	—	—	—	Some bleeding	Printing inks; also rubber	33
Insol	V.good	V.good	V.good	Poor	Good	3–4	None	Printing inks, paints (high strength and good resistance to baking), plastics, rubber. Also wallpapers and textile printing, especially for glossy prints. Better light fastness than the otherwise similar C.I. Pigment Orange 13	34
Insol	Insol	Insol	Insol	—	—	—	None	Printing inks and paints	35
5	5	5	—	—	—	5	5	Paints, plastics and printing inks	36
									37
5	*NaOH* 1% V.good	H_2SO_4 1% V.good	—	—	—	V.good	V.good	Paints, printing inks and plastics generally	38
V.good	Trace redder	Yellower	V. good	—	—	—	—	Cosmetics The parent dye is C.I. Acid Orange 11	39
—	—	—	—	—	—	—	—	**Textiles**—See C.I. Vat Orange 9	40
									41
—	—	—	—	—	—	—	—	Paints of most types	42

C.I. Pigment Orange 43—46

C.I. Pigment Orange	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C	Stability °C
43	**71105**	Anthra-quinone	Orange	5	—	4–5	4–5	4–5	4–5	4–5	—	—	Stable to 200 (Litho-graphic varnish)
44	—	Disazo	Reddish Orange	—	—	—	5	—	5	5	4–5 (strong shades) 2 (pale shades)	—	duller 180 (30 min)
45	This C.I. Generic Name is discontinued All information is transferred to C.I. Pigment Orange 21:1												
46	**15602**	Monoazo	Bright Reddish Orange (Barium Salt of Acid dye)	Excellent	—	—	Fair	—	—	Good	—		Good

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Orange
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
5	—	—	5	—	—	—	5	Paints, printing inks; vinyl and polyolefin plastics **Textiles** – See C.I. Vat Orange 7	**43**
5	—	5	5	5	—	—	5	Paints (oil, water and synthetic resin bound), NC lacquers, printing inks of all types	**44**
									45
Good	V.good	V.good		—	—	—	Poor	Printing inks (including flexographic, rotogravure and foil), plastics, rubber and paint **Literature** *USP* 2598483	**46**

C.I. Pigment Red	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
1	12070	Monoazo (Pigment)	Dull Red	2–3	1–2	2	2	2	1–2	1–2	6–7 (Full strength) 4–5 (½ strength)	256 / Darkens above 120
2	12310	Monoazo (Pigment)	Yellowish Red (*tint* Pink)	2–3	1	2–3	2	1–2	2	1–2	7 (Full strength) 5–6 (½ strength)	310–311 / Stable to 180 (10 min)
3	12120	Monoazo (Pigment)	Yellowish Red	1–2	1	1–2	2–3	1	2	2	7–8 (Full strength) 6 (½ strength)	278 / Stable to 150 (30 min)
4	12085	Monoazo (Pigment)	Yellowish Red (*tint* Reddish Orange)	1	1	2–3	2–3	1–2	2	1–2	7 (Full strength) 5–6 (½ strength)	— / Stable to 150 (20 min)
5	12490	Monoazo (Pigment)	Bright Red	—	—	—	Fair	Poor	Poor	Fair	V. good	306 (dec.) / Stable to 160
6	12090	Monoazo (Pigment)	Bright Yellowish Red	Poor	—	—	Poor	—	Poor	Poor	V. good	— / Good (becomes little bluer)

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Red
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticiers	PVC migration	Soap gel bleeding		
4	4–5	4–5	2–3	3	1–2	—	2	Relatively inexpensive pigment of high tinctorial strength. Paper coating, wallpaper and distemper. Paints and printing inks, alkyd resin enamels and lacquers but limited by solvent solubility. Also in bookcloth, leather finishes, tinplate printing inks, rubber, plastics, and vinyl products **Standards** US ASTM D475–49 Pure Para Red Toner, Light US ASTM D475–50 Pure Para Red Toner	1
Note: Some brands, designated in some cases by **B** in the brand letters, are of bluer shade. They are made from 2-naphthol containing a proportion of F acid (2-naphthol-7-sulphonic acid). The product is washed to remove water soluble dye from the pigment									
5	5	5	2–3	2–3	2–3	—	3–4	Paints, printing inks, alkyd resin enamels, lacquers and emulsion paints. Also paper, linoleum, plastics, vinyl products, rubber. Mass pigmentation of viscose where the pure hue and stability to chemical reagents are advantageous	2
5	5	5	4–5	4–5	3–4	—	3	One of the most widely used of all red pigments on account of the bright scarlet hue, high tinctorial strength, good fastness to acids, alkalis and to light and economy. Some limitation is imposed by the relatively poor fastness to organic solvents Widely used in paints, printing inks, emulsion paints and distempers. Other uses are in synthetic resin lacquers and leather finishes, inks for foil and tinplate printing, paper coating and dyeing, wallpaper, linoleum, carbon papers, typewriter ribbons and student-grade artist materials. Rubber, with good strength and fastness to vulcanisation but limited by solubility in rubber; celluloid, cellulose acetate, P/F, U/F, styrene and protein plastics but suffers from migration in some cases. Cement, because of fastness to lime. Textile printing for 'print on' style with Aniline Black	3
Standard BS 3599/1–5: 1963 Toluidine Red									
5	4 (Yellower)	4–5	2–3	3	2–3	—	3–4	Extensively used for paints, printing inks (high tinctorial strength, hiding power and light fastness) and much used also for emulsion paints and distempers. Synthetic resin lacquers (limited by solvent solubility). Paper, linoleum, leather finishes, P/F, U/F resins, inks for foil printing, student-grade artist materials, cosmetics. Rubber and PVC (some migration). Some use in textile printing	4
Standard BS 3599/1–5: 1963 Chlorinated *p*-Nitroaniline Red									
Insol	Unalt	Unalt	V.good	Poor	—	—	None	Essentially printing inks including inks for foils and soap wrappers. Also emulsion paints and occasionally oil paints, lacquers, rubber and mass pigmentation of viscose, plastics and paper coating **Literature**: *FIAT* 1313, **3**, 495	5
Standard BS 3599/6–15: 1964 Carmine FB									
Insol	V.good	V.good	V.good	V.good	—	—	Slight	Oil paints, alkyd resin enamels, lacquers, emulsion paints and occasionally textile printing, printing inks, rubber, paper, plastics and vinyl products	6

C.I. Pigment Red 7—19

C.I. Pigment Red	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C	Stability °C
7	12420	Monoazo (Pigment)	Red (*tint* Bluish Pink)	1	1	1	1	1	1	1	7–8 (Full strength) 7 (½ strength)	285	4–5 150 (20 min)
8	12335	Monoazo (Pigment)	Yellowish Red (*tint* Bluish Pink)	3	1–2	1–2	2	1–2	1	1	5–6 (Full strength)	305	4–5 150 (20 min)
9	12460	Monoazo (Pigment)	Yellowish Red (*tint* Pink)	1–2	1	2	2	2	1	1–2	7–8 (Full strength) 7 (½ strength)	280	4–5 150 (20 min)
10	12440	Monoazo (Pigment)	Yellowish Red (*tint* Pink)	2–3	2	2–3	2	2	2	2	7–8 (Full strength) 7 (½ strength)	295	4–5 150 (20 min)
11	12430	Monoazo (Pigment)	Bright Bluish Red (*tint* Reddish Violet)	2	2	2	1–2	1–2	1	1	7 (Full strength) 6 (½ strength)	285	4–5 150 (20 min)
12	12385	Monoazo (Pigment)	Bluish Red (*tint* Reddish Violet)	2–3	2	2	2–3	1	1	1–2	6	292	4–5 150 (20 min)
13	12395	Monoazo (Pigment)	Bright Bluish Red	Insol	—	—	V. good	—	Poor	V. good	V. good	—	Good
14	12380	Monoazo (Pigment)	Bluish Red	V. good	—	—	Poor	—	Poor	Poor	Good	—	—
15	12465	Monoazo (Pigment)	Dull Bluish Red	Insol	—	—	Poor	—	Poor	Poor	Good	—	—
16	12500	Monoazo (Pigment)	Bluish Red	—	—	—	Poor	—	Poor	Poor	V. good	315	Good to 140
17	12390	Monoazo (Pigment)	Bright Red	Insol	—	—	Poor	—	Poor	Poor	Good	286	Good
18	12350	Monoazo (Pigment)	Bluish Red→ Dull Red	V. good	—	—	Poor	—	Poor	Poor	Good	—	Fair
19	12400	Monoazo	Brownish Red→Reddish Brown	V. good	—	—	Poor	—	Poor	Poor	Good	—	Good

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Red
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
5	4 (Yellower)	4–5	1–2	1–2	1	—	3–4	Paints, printing inks (trichromatic lithographic printing and wrappers); mass pigmentation of viscose (good chemical stability); emulsion paints and distempers. Also paper, linoleum, cosmetics	7
	Standard BS 3599/6–15: 1964 Red F4RH								
4–5	4	4–5	4–5	4	2–3	—	3–4	Mainly printing inks. Paints, paper, linoleum, vinyl plastics, cosmetics	8
4–5	4–5	4–5	3	2–3	2–3	—	1	Mainly printing inks, including inks for wrappers. Paints, linoleum, paper	9
	Standard BS 3599/6–15: 1964 Red FRLL								
4–5	4–5	4–5	3	3	2–3	—	3–4	Paints and printing inks, including wrapper printing; linoleum, cosmetics. Some use in rubber, lacquers, emulsion paints and distempers	10
	Standard BS 3599/6–15: 1964 Red FRL								
5	3 (Yellower)	4–5	2–3	2–3	2	—	4	Paints, printing inks (including wrapper printing), emulsion paints; linoleum and paper; various plastic materials	11
5	4–5	4–5	4	4–5	2–4	—	4		
	Standard BS 3599/6–15: 1964 Bordeaux F2R							Mainly paints and printing inks. Wrapper printing, paper coating, thermosetting resins, linoleum. Also leather finishes, emulsion paints and distempers. Limited use in lacquers	12
Insol	Unalt	Unalt	—	V. good	—	—	Slight	Oil and emulsion paints, alkyd resin enamels, lacquers, printing inks, textile printing and occasionally rubber, paper, vinyl products and plastics	13
—	Unalt	Unalt	—	—	—	—	—	Oil paints, alkyd resin enamels and lacquers. Occasionally emulsion paints, textile printing, printing inks, rubber, paper, plastics and vinyl products	14
—	Unalt	Unalt	—	—	—	Migrates	—	Oil paints, alkyd resin enamels and lacquers. Occasionally emulsion paints, textile printing, printing inks, paper and plastics	15
Insol	Unalt	Unalt	—	Poor	—	—	None	Mainly printing inks and paints. Limited use in lacquers (not fast to overvarnishing)	16
Insol	Unalt	Unalt	—	—	—	—	None	Textile printing	17
Insol	Unalt	Unalt	—	V. good	—	—	None	Lacquers, paints. Occasionally printing inks, textile printing, emulsion paints, rubber, paper, plastics and vinyl products. Cosmetics	18
V. good	V. good	Unalt	—	V. good	—	—	—	Lacquers, alkyd resin enamels, paints. Occasionally printing inks, emulsion paints, textile printing, rubber, paper, plastics and vinyl products	19

C.I. Pigment Red	C.I. Constitution No.	Chemical Class	Hue	FASTNESS									
				ORGANIC SOLVENTS							Light	Heat	
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C	Stability °C
20	—	Azo (Pigment)	Bright Yellowish Red	—	—	—	—	—	—	Insol	Good	—	Good
21	12300	Monoazo (Pigment)	Bright Yellowish Red	—	Poor	—	Poor	—	Poor	Poor	Excellent	—	Stable to 150
22	12315	Monoazo (Pigment)	Red	V. good	Poor	—	Poor–fair	—	Poor–fair	Poor–fair	Fair	—	Good
23	12355	Monoazo (Pigment)	Bluish Red	Insol	—	—	Poor	—	Poor	Poor	Fair	—	Good
24	—	—		This C.I. Generic Name is discontinued Pigments formerly listed under it now appear under C.I. Pigment Red 23									
25	—	Monoazo (Pigment)	Yellowish Red	Poor	—	—	Poor	—	—	—	Fair–good	—	Good
26	—	Monoazo (Pigment)	Bluish Red	—	Poor	—	Poor	—	Poor	Poor	Excellent	—	Stable to 150
27	—	—	—	This C.I. Generic Name is discontinued Pigments formerly listed under it now appear under C.I. Pigment Red 22									
28	—	—	—	This C.I. Generic Name is discontinued Pigments formerly listed under it now appear under C.I. Pigment Red 17									
29	—	Monoazo (Pigment)	Bluish Red	—	—	—	—	—	Poor	Poor	—	—	—
30	12330	Monoazo (Pigment)	Red	—	—	—	V. good	—	V. good	Poor	V. good	—	Stable to 150
31	12360	Monoazo (Pigment)	Bluish Red	—	—	—	V. good	—	—	Fair (benzene)	V. good	—	Stable to 150
32	12320	Monoazo (Pigment)	Bluish Red	—	—	—	Poor	—	Poor	Poor	V. good	—	Stable to 150
33	—	—	—	This C.I. Generic Name is discontinued. Pigments formerly listed under it now appear under C.I. Pigment Red 4									
34	—	Monoazo (Pigment)	Bluish Red	—	Poor	—	Poor	—	Poor	Poor	Excellent	—	Stable to 150
35	—	Azo (Pigment)	Bright Red	V. good	—	—	V. good	—	Poor	Poor	V. good	—	—
36	—	—	—	This C.I. Generic Name is discontinued. Pigments formerly listed under it now appear under C.I. Pigment Red 23									
37	21205	Disazo (Pigment)	Yellowish Red	—	—	—	Poor	—	Poor	Poor	V. good	—	Stable to 150

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Red
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Insol	Unalt	—	—	—	—	—	None	Rubber. Occasionally plastics and vinyl products	20
Insol	Unalt	Unalt	Poor	Poor	—	—	None	Soap and wax products. Occasionally paints, printing inks, lacquers, emulsion paints and distempers	21
Insol	Unalt	Unalt	Poor	Poor	—	—	Good	Paints, printing inks and textile printing; also alkyd resin enamels, lacquers, emulsion paints, paper, plastics and vinyl products and occasionally rubber	22
Insol	V.good	Unalt	—	V.good	—	—	None	Paints, printing inks and linoleum. Also textile printing, rubber and plastics, alkyd resin enamels, lacquers, emulsion paints, paper	23
									24
V.good	Unalt	Unalt	—	—	—	—	Slight	Printing inks. Occasionally oil and emulsion paints **Constitution**—the coupling component is a 3-hydroxy-2-naphthoic arylide	25
Insol	Unalt	Unalt	V.good	Poor	—	—	Bleeds	Lacquers. Also oil and emulsion paints and distempers **Constitution**—the coupling component is a 3-hydroxy-2-naphthoic arylide	26
									27
									28
Insol	Fair (bleeds)	Fair (bleeds)	—	—	—	—	—	Oil paints, alkyd resin enamels and occasionally lacquers **Constitution**—the coupling component is a 3-hydroxy-2-naphthoic arylide	29
Insol	Unalt	Unalt	Insol	Poor	—	—	None	Rubber **Literature**: *FIAT* 1313, **2**, 285; **3**, 214	30
Insol	Unalt	Unalt	—	—	—	—	None	Rubber, printing inks and paints **Literature**: *FIAT* 1313, **3**, 214, 506	31
Insol	—	—	V.good	Poor	—	—	None	Rubber	32
									33
Insol	Unalt	V.good	V.good	Poor	—	—	Slight	Paints and lacquers	34
Insol	Poor	Poor	—	—	—	—	None	Paints, printing inks and plastics	35
									36
Insol	Unalt	Unalt	V.good	Poor	—	—	None	Rubber and similar products, especially PVC **Literature**: I.G., *BP* 412992; *USP* 1995902; *GP* 596755 (*Fr.* **21**, 953)	37

C.I. Pigment Red 38—48:3

C.I. Pigment Red	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C	Stability °C
38	21120	Disazo (Pigment)	Red	V. good	—	—	Good	—	V. good	Poor	V. good	—	V. good
39	21080	Disazo (Pigment)	Bluish Red	—	—	—	V. good (bleeds slightly)	—	V. good (bleeds slightly)	V. good (bleeds slightly)	Good	—	—
40	12170	Monoazo (Pigment)	Bright Bluish Red	—	—	—	Poor	—	Poor	Poor	Fair	—	Stable to 120 (1 hr)
41	21200	Disazo (Pigment)	Red	V. slight bleed	—	—	Slight bleed	—	Slight bleed	Bleeds	V. good	—	Excellent
42	21210	Disazo (Pigment)	Bordeaux	Insol	—	—	Fair	—	Excel-lent	V. good	V. good (Full strength) Fair (Tints)	—	Excellent
43	—	—	—	This C.I. Generic Name is discontinued Pigments formerly listed under it now appear under C.I. Pigment Red 22									
44	—	Disazo (Pigment)	Bright Red	—	V. good	—	V. good	—	V. good	V. good	Fair	—	Stable to 150
45	—	Monoazo (Pigment)	Bright Red	—	V. good	—	V. good	—	V. good	V. good	Good	—	Stable to 150
46	—	Organic (Pigment)	Bright Red	—	V. good	—	Insol	—	V. good	V. good	Good	—	—
47	—	Organic (Salt of Acid dye)	Bright Yellowish Red	Insol	—	—	Insol	—	Insol	Insol	Fair	—	Good
48	15865	Monoazo (Sodium salt of Acid dye)	Bright Orange	—	—	—	—	—	—	—	—	—	—
48:1	15865:1	Monoazo (Barium salt of Acid dye)	Bright Yellowish Red (*tint* Pink)	Insol	Insol	—	Insol	—	V. good	Insol	Good	—	Fair (darkens)
48:2	15865:2	Monoazo (Calcium salt of Acid dye)	Bright Red (*tint* Bluish Pink)	Insol	Insol	—	Insol	—	V. good	Insol	V. good	—	Fair (darkens)
48:3	15865:3	Monoazo (Strontium salt of Acid dye)	Red	—	—	—	—	—	—	—	—	—	—

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Red
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Insol	Unalt	Unalt	—	Good	—	—	Slight	Rubber and plastics, especially vinyl products, occasionally printing inks, lacquers, emulsion paints and in textile printing **Literature**: I.G., *BP* 431195; *USP* 1977936, 2002174; *GP* 618342 (*Fr.* 22, 933)	38
Insol	Unalt	Unalt	—	Insol	—	—	—	Plastics	39
Insol	Unalt	Unalt	Poor	Poor	—	—	None	Paints, lacquers, emulsion paints, distempers As Solvent dye see C.I. Solvent Red 4	40
Insol	Slight bleed	Unalt	—	Insol	—	—	None	Rubber and plastics including vinyl products; occasionally printing inks	41
Insol	Unalt	Unalt	Excellent	Insol	Excellent	—	Excellent	Paints, printing inks, plastics, rubber	42
									43
Insol	Unalt	Unalt	V.good	V.good	—	—	None	Rubber and PVC, giving outstanding tinctorial strength; occasionally in printing inks	44
Insol	Unalt	Unalt	Insol	—	—	—	None	Primarily lacquers; also tin-foil printing, the fastness to solvents being an advantage, and soap wrapper printing	45
Insol	Poor	V.good	Insol	V.good	—	—	—	Mass coloration of viscose rayon	46
V.good	Poor	V.good	—	—	—	—	Severe	Alkyd resin enamels, lacquers and printing inks	47
—	—	—	—	—	—	—	—	Primarily for manufacture of the alkaline earth and heavy metal salts detailed immediately following. Very occasionally as a pigment for printing inks	48
Insol	V.good	Unalt	V.good	V.good	V.good	—	Bleeds	Primarily in printing inks of high tinctorial strength with bronze overtones, economical in use. Important use in paints, alkyd resin enamels and lacquers, rubber and paper. Also in linoleum, book cloth and leather cloth, inks for wrapper and tinplate printing, PVC, U/F and P/F plastics, cosmetics and textile printing	48:1
Insol	Fair–good	Unalt	V.good	V.good	V.good	—	Bleeds	As for C.I. Pigment Red 48:1 above. In printing inks notable for rich bluish undertones	48:2
—	—	—	—	—	—	—	—		48:3

C.I. Pigment Red	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
48:4	15865:4	Monoazo (Manganese salt of Acid dye)	Red	Insol	—	—	Insol	—	Insol	Insol	V. good	— / Fair (darkens)
49	15630	Monoazo (Sodium salt of Acid dye)	Yellowish Red (*tint* Yellowish Pink)	—	Poor	—	Poor	—	Poor	Insol	Fair	— / Stable to 130
49:1	15630:1	Monoazo (Barium salt of Acid dye)	Red (*tint* Bluish Pink)	V. good	Fair	—	Fair	—	Fair–good	Good–v. good	Fair–good	— / Stable to 150
49:2	15630:2	Monoazo (Calcium salt of Acid dye)	Bright Bluish Red (*tint* Bluish Pink)	V. good	Fair	—	Fair	—	Fair–good	Good–v. good	Fair–good	— / Stable to 150
49:3	15630:3	Monoazo (Strontium salt of Acid dye)	Bright Bluish Red	—	—	—	—	—	—	—	—	— / —
50	15500	Monoazo (Sodium salt of Acid dye)		—	—	—	—	—	—	—	—	— / —
50:1	15500:1	Monoazo (Barium salt of Acid dye)	Reddish Orange (*tint* Bluish Pink)	Insol	V. good	—	V. good	—	V. good	V. good	Fair	— / Good
50:2	15500:2	Monoazo (Calcium salt of Acid dye)		—	—	—	—	—	—	—	—	— / Fair to 120
51	15580	Monoazo (Barium salt of Acid dye)	Yellowish Red (*tint* Pink)	3	1	3	2	3	2	2–3	4–5 (Full strength) 3 (½ strength)	— / 4 120 (20 min) duller
52	15860	Monoazo (Sodium salt of Acid dye)	—	—	—	—	—	—	—	—	—	— / —
52:1	15860:1	Monoazo (Calcium salt of Acid dye)	Bright Red	Excellent	—	—	Poor	—	Good	Excellent	Good	— / Good

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Red
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Insol	V. good	V. good	—	Insol	—	—	Severe	Paints, alkyd resin enamels, lacquers, plastics and vinyl products. Occasionally emulsion paints, printing inks, paper, textile printing. Very occasionally rubber	48:4
Poor	Good	Good (darkens)	V. good	V. good	—	—	Bleeds	Primarily for the manufacture of the alkaline earth metal lakes detailed immediately following but has important uses in printing inks (good covering power) in rubber and in enamels **Literature** *BIOS* 1661, 106, 107, 166 *FIAT* 1313, **3,** 506	49
Insol	Good	V. good	Good	Fair	—	—	Bleeds	Economical pigment when conditions are not too severe. Used in printing inks and paints, having high tinctorial strength; in alkyd resin enamels and lacquers when the solvent fastness is sufficient; rubber, though subject to some migration. Also linoleum, paper coating, emulsion paints, inks for wrapper, wallpaper and foil printing; PVC; U/F, P/F, polystyrene and amino resins and plastics; student grade artists' colouring materials	49:1
Insol	Good	V. good	Good	Fair	—	—	Bleeds	As for C.I. Pigment Red 49:1 (above)	49:2
—	—	—	—	—	—	—	—	Cosmetics	49:3
—	—	—	—	—	—	—	—	Manufacture of barium and calcium salts as pigments detailed immediately below. Also used in drugs and cosmetics	50
V. good	V. good	V. good	V. good	Good	—	—	Slight	Printing inks, especially offset inks to give a bronzy lustre. Unsuitable for use with cobalt driers as these cause darkening	50:1
—	—	—	—	—	—	—	—	Drugs and cosmetics	50:2
3–4	3	4–5	3	3	1—2	—	1	Primarily in printing inks. Some use in paints, synthetic resin lacquer; rubber; PVC, U/F and P/F, polystyrene, polyethylene and amino plastics; paper coating, wallpaper printing, foil printing. Textile printing, print on style with Aniline Black	51
—	—	—	—	—	—	—	—	Manufacture of salts detailed immediately following for use as pigments	52
Excellent	Fair	Good	—	—	—	—	Poor	Enamels, lacquers, printing inks, plastics, floor coverings and occasionally emulsion paints	52:1

C.I. Pigment Red 52:2—57:2

C.I. Pigment Red	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
52:2	15860:2	Monoazo (Manganese salt of Acid dye)	Bordeaux	V. good	—	—	Fair	—	Fair	V. good	Good	— / Fair
53	15585	Monoazo (Sodium salt of Acid dye)	Bright Reddish Orange	V. good	Poor	—	Poor	—	Poor	Insol	Poor–fair	— / Stable to 150
53:1	15585:1	Monoazo (Barium salt of Acid dye)	Yellowish Red (*tint* Pink)	V. good	Poor	—	V. good	—	Poor–fair	Insol	Fair	— / Stable to 150
53:2	15585:2	Monoazo (Calcium salt of Acid dye)	Red (somewhat brownish)	—	—	—	—	—	—	—	—	— / —
54	14830:1	Monoazo (Calcium salt of Acid dye)	Bluish Red (*tint* Pale Reddish Violet)	Insol	Poor–fair	Fair	Poor	Poor	Fair–good	V. good	Good	— / Stable to 150
55	15820	Monoazo (Manganese salt of Acid dye)	Bordeaux	Insol	—	—	V. good	—	V. good	V. good	V. good	— / —
56	15870	Monoazo Barium salt of Acid dye)	Bright Bluish Red	—	V. good	—	V. good	—	V. good	Insol	Good	— / Good
57	15850	Monoazo (Sodium salt of Acid dye)		—	—	—	—	—	—	—	—	— / —
57:1	15850:1	Monoazo (Calcium salt of Acid dye)	Red (*tint* Pale Reddish Violet)	V. good	Fair	V. good	V. good	Good	Fair	V. good	Good	— / Stable to 150
57:2	15850:2	Monoazo (Barium salt of Acid dye)	Bluish Red	5	—	5	4	5	4–5	3	5 (Lacquer)	— / Stable to 140–160

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Red
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Excellent	Fair	Fair	—	—	—	—	Fair	As for C.I. Pigment Red 52:1 (above)	**52:2**
Fair	V.good	Good	V.good	V.good	—	—	Bleeds	Primarily for the manufacture of alkaline earth metal salts for use as pigments as detailed immediately following. Some use in printing inks (high tinctorial strength and clean, bright undertone). Also in PVC, P/F and U/F plastics and rubber	**53**
Insol	V.good	V.good	Insol	V.good	—	—	Bleeds	Printing inks (bronze top tone and clean bright undertone but use limited by only moderate fastness to light). Also rubber, PVC, U/F and P/F moulding powders and plastics, stoving finishes, foil inks, paper colouring, cosmetics	**53:1**
Partially soluble	—	—	—	—	—	—	—		**53:2**
Insol	Fair	V.good	V.good	V.good	Good	—	Bleeds	Pigment of high tinctorial strength and bright hue, economical in use. Printing inks; paints, alkyd resin enamels and lacquers. Also amino, polystyrene, polyethylene, and protein plastics and rubber; paper coating and wallpaper printing, bookcloth, inks for foil printing **Textiles:** The corresponding sodium salt is C.I. Acid Red 20	**54**
Insol	V.good	Unalt	—	Poor	—	—	—	Alkyd resin enamels and lacquers; occasionally paints, printing inks, rubber and plastics	**55**
Insol	Good	Good	V.good	—	—	—	None	Paints, printing inks and occasionally lacquers; also inks for wallpaper and for tin printing	**56**
—	—	—	—	—	—	—	—	Primarily for manufacture of the alkaline earth metal salts, especially the calcium salt, for use as pigments as detailed immediately following	**57**
Insol	Good–V.good (yellower)	Fair–good (darker)	V.good	V.good	3–5	—	Bleeds	Primarily in printing inks (rich bluish undertone and bronze overtone with good strength and covering power). Important usage in paints, alkyd resin enamels, lacquers, rubber and vinyl products. Also used in emulsion paints, paper coating, wallpaper, linoleum, PVC and plastics of most types; leather finishes, inks for tin plate and foil printing; textile printing, cosmetics	**57:1**
4	2	—	4	—	—	—	1	Printing inks, emulsion paints, NC, polyester and polyurethane lacquers; oil paints	**57:2**

C.I. Pigment Red	C.I. Constitution No.	Chemical Class	Hue	FASTNESS									
				ORGANIC SOLVENTS							Light	Heat	
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C	Stability °C
58	15825	Monoazo (Sodium salt of Acid dye)	—	—	—	—	—	—	—	—	—	—	—
58:1	15825:1	Monoazo (Barium salt of Acid dye)	Bright Red	Insol	V. good	—	Insol	—	Insol	Insol	Good	—	Good
58:2	15825:2	Monoazo (Calcium salt of Acid dye)	Bright Bluish Red	Insol	V. good	—	Insol	—	Insol	Insol	Good	—	Good
58:3	15825:3	Monoazo (Strontium salt of Acid dye)	Bright Reddish Orange	Insol	V. good	—	V. good	—	V. good	Insol	Good	—	Good
58:4	15825:4	Monoazo (Manganese salt of Acid dye)	Bluish Red	Insol	V. good	—	Insol	—	Insol	Insol	Good	—	Good
59	—	Organic (Salt of Acid dye)	Bright Red	—	—	—	V. good	—	V. good	Good (Toluene)	V. good	—	Stable to 180
60	16105	Monoazo (Sodium salt of Acid dye)	—	—	—	—	—	—	—	—	—	—	—
60:1	16105:1	Monoazo (Barium salt of Acid dye)	Bright Red	Insol	V. good	V. good	V. good	V. good	V. good	Insol	5–6 (Full strength)	—	Stable to 150
61	24830	Disazo (Sodium salt of Acid dye)	—	—	—	—	—	—	—	—	—	—	—
61:1	24830:1	Disazo (Barium salt of Acid dye)	Bright Bluish Red	—	—	—	Insol	—	Insol	—	Poor	—	Stable to 140
62	23295	Monoazo (Barium salt of Acid dye)	Bright Bluish Red	—	—	—	Insol	—	Insol	—	Fair	—	Stable to 150
63	15880	Monoazo (Sodium salt of Acid dye)	—	—	—	—	—	—	—	—	—	—	—

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Red
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
—	—	—	—	—	—	—	—	Manufacture of alkaline earth and heavy metal salts for use as pigments as detailed immediately following	**58**
Insol	V.good	Unalt	Insol	Insol	—	—	Bleeds	Printing inks	**58:1**
Insol	V.good	Unalt	Insol	Insol	—	—	Bleeds	Primarily in printing inks. Also paints and lacquers; paper colouring; inks for tinplate, wrapper and wallpaper printing; rubber, PVC and plastics, linoleum	**58:2**
Insol	Good	Fair	Insol	Insol	—	—	Bleeds	Primarily in printing inks	**58:3**
Insol	Good–fair	Unalt	V.good	V.good	—	—	Bleeds	Paints, alkyd resin enamels, lacquers, plastics and vinyl products. Occasionally emulsion paints, printing inks, paper and textile printing	**58:4**
V.good	Unalt	Poor	Insol	—	—	—	Bleeds	Paints, printing inks, lacquers and emulsion paints and distempers; also wallpaper, paper coating and thermosetting resins	**59**
—	—	—	—	—	—	—	—	Manufacture of the alkaline earth metal salts, particularly the barium salt on zinc oxide/alumina **Textiles**: See C.I. Mordant Red 9	**60**
Insol	Poor	Poor	Insol	Insol	V.good	—	Severe	Printing inks, lacquers, alkyd resin enamels and paints; inks for wallpaper, wrapper and tin plate printing. Also rubber, PVC, U/F and P/F plastics; paper; emulsion paints; textile printing. C.I. Pigment Red 48 has been largely substituted for C.I. Pigment Red 60:1 in some of these applications	**60:1**
—	—	—	—	—	—	—	—	Manufacture of C.I. Pigment Red 61:1 **Textiles**: See C.I. Acid Red 65	**61**
Insol	Poor	Poor	Insol	—	—	—	—	Primarily for paper coating; occasionally NC lacquers, leather cloth	**61:1**
Insol	Poor	V.good	Insol	—	—	—	—	NC lacquers, leather cloth and paper coating. Somewhat bluer in hue and faster to light than C.I. Pigment Red 61:1. The sodium salt was formerly used as an Acid dye **(Azo Milling Red B(IG))**	**62**
—	—	—	—	—	—	—	—	Manufacture of alkaline earth and heavy metal salts for use as pigments as detailed under C.I. Pigment Reds 63:1 and 63:2	**63**

C.I. Pigment Red	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
63:1	15880:1	Monoazo (Calcium salt of Acid dye)	Bordeaux	—	Fair	—	Good	—	Poor	Good	Good	— / Fair (darkens at 125–150)
63:2	15880:2	Monoazo (Manganese salt of Acid dye)	Bordeaux	Insol	Fair	—	Fair–v. good	—	Insol	Insol	V. good	— / Fair (darkens at 125–150)
64	15800	Monoazo (Barium salt of Acid dye)	Bright Red	—	—	—	Poor	—	—	—	Good	— / Excellent
64:1	15800:1	Monoazo (Calcium salt of Acid dye)	Bright Red	—	—	—	Poor	—	—	—	Good	— / Excellent
65	18020:1	Monoazo (Barium salt of Acid dye)	Bright Red	—	Good	—	Good	—	Good	Good	Fair	— / Stable to 150
66	18000:1	Monoazo (Barium salt of Acid dye)	Bright Red	—	V. good	—	V. good	—	V. good	V. good	V. good	— / Stable to 150
67	18025:1	Monoazo (Barium salt of Acid dye)	Bright Bluish Red	—	Good	—	Good	—	Good	Good	Fair	— / Stable to 150
68	15525	Monoazo (Calcium salt of Acid dye)	Bright Yellowish Red	—	—	—	V. good	—	V. good	V. good	V. good	— / Stable to 140
69	15595	Monoazo (Sodium salt of Acid dye)	Bright Yellowish Red	—	V. good	—	V. good	—	—	V. good	Good	— / V. good
70	15590	Monoazo (Barium salt of Acid dye)	Bright Yellowish Red	—	V. good	—	Insol	—	Insol	Insol	Good	— / Good
71	—	Metal salt of Acid dye	Yellowish Red	Insol	—	—	—	—	Insol	—	Good	— / —
72	—	Metal salt of Acid dye	Red	Insol	—	—	—	—	V. good	—	Fair	— / —

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Red
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Insol	Poor–fair	Unalt	V.good	V.good	—	—	Bleeds	Paints, alkyd resins, enamels and printing inks including inks for wallpaper and tin printing; rubber, vinyls and plastics, linoleum and leather cloth. Occasionally NC lacquers	63:1
Insol	Unalt	Fair	V.good	V.good	—	—	Bleeds	Lacquers, paints, alkyd resin enamels; vinyls and plastics, leather cloth, linoleum. Occasionally printing inks, paper, emulsion paints and textile printing	63:2
Insol	Unalt	V.good	—	—	—	—	—	Paints, varnishes, printing inks; also rubber and plastics. Cosmetics **Literature**: Agfa, *FP* 328575, *GP* 145913 (*Fr.* 7, 449)	64
Insol	—	—	—	—	—	—	—	Cosmetics	64:1
Insol	Poor	V.good	Insol	Insol	—	—	Slight	Rubber and synthetic rubbers, being semi-transparent, of high strength and tinctorial value, without effect on ageing and fast to pressure vulcanisation. Occasionally printing inks and lacquers **Textiles**: The corresponding sodium salt is C.I. Acid Red 110	65
Insol	Poor	V.good	Insol	Insol	—	—	Slight	Rubber, having good transparency, brightness and fastness to solvents **Textiles**: The corresponding sodium salt is C.I. Acid Red 108	66
Insol	Fair–good	V.good	Insol	Insol	—	—	Slight	Rubber and synthetic rubbers, being semi-transparent, of high strength and tinctorial value, without effect on ageing and fast to pressure and cold vulcanisation **Textiles**: The corresponding sodium salt is C.I. Acid Red 107	67
Poor	Poor	Poor	V.good	V.good	—	—	Bleeds	Primarily printing inks; also in plastics **Literature**: *FIAT* 1313, **3**, 490	68
V.good	—	—	V.good	V.good	—	—	Slight	Paints and printing inks including tinplate printing; also linoleum	69
—	V.good	V.good	Insol	Insol	—	—	Bleeds	Paints, printing inks and lacquers	70
V.good	—	V.good	—	—	—	—	—	Paints, printing inks	71
V.good	—	Poor	—	—	—	—	—	Paints, printing inks, alkyd resin enamels, lacquers, emulsion paints, plastics and for textile printing; occasionally paper and vinyl products	72

C.I. Pigment Red	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
73	—	Metal salt of Acid dye	Bluish Red	Insol	—	—	—	—	Insol	—	Good	— / —
74	—	Metal salt of Acid dye	Bluish Red	Insol	—	—	—	—	V. good	—	Good	— / —
75	—	Azo (Metal salt of Acid dye)	Bright Bluish Red	Insol	—	—	Insol	—	Insol	Insol	Good	— / Good
76	—	—	—	This C.I. Generic Name is discontinued. Pigments formerly listed under it now appear under C.I. Pigment Red 52								
77	15826	Monoazo	Bright Red	Insol	—	—	Insol	—	Insol	Insol	Good	— / Good
78	—	Metal salt of Acid dye	Bright Bluish Red	—	—	—	—	—	—	V. good	Good	— / Good
79	—	—	—	This C.I. Generic Name is discontinued. Pigments formerly listed under it now appear under C.I. Pigment Red 81								
80	—	—	—	This C.I. Generic Name is discontinued. Pigments formerly listed under it now appear under C.I. Pigment Red 81								
81	45160:1	Xanthene PTMA* salt of Basic dye	Bright Bluish Red	5	2	4–5	1–2	1	1	4–5	5 (Full strength) 3–4 (⅓ strength)	— / 4–5 (120–60 min) 4 (150–30 min)
82	45150:1	Xanthene (PTMA salt of Basic dye)	Bright Red	—	Poor	—	Poor	—	Poor	Insol	Good–fair	— / Good to 150 (becomes slightly browner)
83	58000:1	Anthraquinone (Metal compounds)	Yellowish Red→ Bordeaux	Insol	—	V. good	V. good	V. good	Good	Insol	7 (Full strength) 5 (½ strength)	— / 4 120–30 min 3–4 150–20 min
84	58210	Anthraquinone (Aluminium salt of Acid dye)	Bright Bluish Red	—	Insol	—	Insol	—	Insol	Insol	V. good	— / Stable to 120

Note: PTMA = Phosphotungstomolybdic acid. *Some brands are phosphomolybdic or phosphotungstic acid salts

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Red
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Insol	—	Unalt	—	V.good	—	—	—	Paints, printing inks, alkyd resin enamels, lacquers, emulsion paints, paper, rubber, vinyl products, plastics and for textile printing	73
V.good	—	V.good	—	V.good	—	—	—	Paints, printing inks, alkyd resin enamels, lacquers, emulsion paints, paper, rubber, vinyl products, plastics and textile printing	74
Insol	V.good	Unalt	—	Insol	—	—	Severe	Printing inks and plastics	75
									76
Insol	Unalt	Unalt	—	Insol	—	—	Severe	Paints, alkyd resin enamels, lacquers, plastics, vinyl products and occasionally printing inks	77
Insol	Unalt	—	—	—	—	—	None	Rubber, occasionally plastics and vinyl products	78
									79
									80
4–5	Poor–fair	5	5	4–5	2–4	—	1	Primarily for printing inks where the bright shade, transparency and high tinctorial value are of special value. Also wrapper and tinplate printing, paper coating and staining, crayons and coloured pencils, typewriter ribbons and copying papers and occasionally alkyd resin enamels, lacquers, emulsion paints, plastics and vinyl products and textile printing The parent dye is C.I. Basic Red 1 *Discoverers*: C. Immerheiser and B. Zschimmer 1925; P. Rabe 1926 **Literature** I.G., *BP* 265032; *FP* 608301; *GP* 449539 (*Fr.* **15**, 1815); *BP* 292253, 294286; *USP* 1736835; *GP* 503811 (*Fr.* **17**, 1506) *BIOS* 961, 27 *BIOS* 1661, 16, 30 *FIAT* 764—Fanalrosa B Supra Plv.	81
Insol	V.good	Unalt	V.good	V.good	—	—	Bleeds	Closely similar to that of C.I. Pigment Red 81 The parent dye is C.I. Basic Red 8	82
Insol	Fair–good	Fair–good	Insol	Insol	V.good	—	Slight	**Alizarine Lakes** or **Madder Lakes** A large range of pigments is made from natural madder or synthetic alizarine by combination with various metals or mixtures of metals. The metals most commonly used are Aluminium (orange and red), Calcium (red and bluish red) and Iron (bordeaux and violet). Because of their general insolubility in solvents and high light fastness these pigments are used for a wide variety of purposes: paints, alkyd resin enamels, printing inks, lacquers and occasionally emulsion paints; inks for printing process generally including textile printing, wallpaper, wrappers and tinplate; rubber, vinyl products, plastics; artists' water and oil colours; cosmetics. The hiding power of Alizarine (Madder) Lakes is generally poor The parent dye is C.I. Mordant Red 11	83
Insol	Poor	Poor	Insol	Insol	—	—	Slight	Lacquers (but does not withstand high temperatures); also paints and printing inks. (The chromium salt is bordeaux)	84

C.I. Pigment Red	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability C°
85	**63350**	Anthraquinone (Pigment)	Bordeaux	Poor	—	—	Poor	—	Poor	Poor	V. good	— / —
86	**73375**	Indigoid (Pigment)	Bright Red	Insol	—	—	V. good	—	V. good	Insol	V. good	— / Good
87	**73310**	Thioindigoid (Pigment)	Bluish Red	Insol	—	—	V. good	—	V. good	V. good	V. good	— / —
88	**73312**	Thioindigoid (Pigment)	Reddish Violet	Good	—	—	Good	—	Good	Good	Good (Exterior full tone and tint tone)	— / —
89	**60745**	Anthraquinone (Pigment)	Bluish Pink	Insol	—	—	Poor	—	—	Poor	V. good	— / —
90	**45380:1**	Xanthene (Lead salt of Acid dye)	Bright Red	—	Poor	—	Poor	—	Poor–good	V. good	Fair	— / Fair Stable to 110
90:1	**45380:3**	Xanthene (Aluminium salt of Acid dye)	Bright Red	Similar to those of C.I. Pigment Red 90								
91	—	—	—	These C.I. Generic Names are discontinued								
92	—	—	—									
93	**12152**	Monoazo (Pigment)	Red	—	—	—	Fair	—	—	—	Fairly good	— / —
94	—	Organic	Red (*tint* Pink)	Insoluble in solvents							Good	— / Stable to 180
95	—	Organic	Bright Red (*tint* Bluish Pink)	Very good fastness to solvents							V. good	— / Stable to 160
96	—	Organic	Bright Red (*tint* Bluish Pink)	Moderate fastness to solvents							V. good	— / Stable to 160
97	—	Organic	Red (*tint* Pink)	Good fastness to solvents							Excellent	— / Stable to 140

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Red
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Insol	V.good	Unalt	—	V.good	—	—	—	Printing inks and alkyd resin enamels; occasionally lacquers **Textiles**—formerly used as a vat dye. Dyeing method A/Q3. Fastness properties (C): Chlorine 4, Light 5–6, Soda boil 3–4	85
Insol	Fair	Fair	—	—	—	—	Slight	Printing inks, plastics and vinyl products; occasionally textile printing **Textiles**—formerly used as a vat dye. Application method: Indigoid. Fastness properties (C): Light 5, Chlorine 4–5, Soda boil 3	86
Insol	Unalt	Unalt	—	Insol	—	—	—	Alkyd resin enamels and lacquers; occasionally for printing inks	87
Insol	Good	Good	—	Good	—	None	Good	Industrial, automotive and architectural paints, printing ink, vinyl and polyolefin plastics, rubber	88
V.good	Poor	Unalt	—	—	—	—	Severe	Printing inks and wallpaper; occasionally for emulsion paints and paper (coating and beater dyeing) **Textiles**—formerly used as a vat dye. Application method: AQ/3. Fastness properties: Light good–very good; Chlorine good	89
V.good	Poor	F.good	V.good	Poor–good	—	—	Bleeds	Principally in printing inks (bronzed tone with brillaint hue). Also coloured pencils and crayons, typewriter ribbons and cosmetics	90
—	—	—	—	—	—	—	—	Cosmetics	90:1
									91
									92
Insol	—	—	Fair	—	—	—	—	Paper colouring and wallpaper	93
Fair	Fair	Good	V.good	—	—	—	—	In NC or synthetic resin pigmenting finishes, baking enamels, plastics and in printing colours fast to overvarnishing; other uses limited by moderate fastness to water and alkalies	94
V.good	Good–v.good	Good–v.good	V.good	—	—	—	—	Printing inks, paints; NC, resin and oil lacquers and varnishes; wallpaper and coated paper	95
V.good	Good–v.good	Good–v.good	Fair	—	—	—	—	Paints, printing inks, wallpaper and coated papers; also NC, resin and oil lacquers and varnishes	96
V.good	Good	Good	Good	—	—	—	—	Paints, printing inks, plastics, paper and wallpaper	97

C.I. Pigment Red	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
98	—	Organic	Bordeaux (*tint* Bright Reddish Violet)	Good to moderate fastness to solvents							V. good	— / Stable to 140 (sublimes at 140)
99	**15570**	Monoazo (Barium salt of Acid dye)	—	Insol	—	—	—	—	—	(*Toluene*) Insol	Fairly good	— / —
100	**13058**	Monoazo (Pigment)	—	V. good	—	—	Slightly soluble	—	—	(*Toluene*) V. good	Poor	— / —
101	**77015 77491 77538**	Inorganic	Dull Reddish Orange→ Dull Yellowish Red→ Dull Red→ Dull Bordeaux	Insoluble in solvents							Excellent	— / Excellent
102	**77015 77491 77538**	—	—	In chemical constitution, hue range, and fastness properties very closely similar to C.I. Pigment Red 101								
103	**77601**	Inorganic	Reddish Orange→ Yellowish Red	Insoluble in organic solvents							6 (Full strength)	— / 4–5 150 (20 min)
104	**77605**	Inorganic	Bright Reddish Orange →Bright Red	Insoluble in organic solvents							6–7 (Full strength)	— / 4–5 150 (20 min)

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Red
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
V.good	Good	F.good	V.good	—	—	—	—	Printing inks, paper and wallpaper	**98**
Fair	—	—	—	Insol	—	—	—	Cosmetics	**99**
V.good	—	—	—	Slightly soluble	—	—	—	Cosmetics	**100**
Insol	Unalt	Poor	Insol	Insol	—	—	None	Manufactured red oxide of iron. Very widely used in industrial paints and enamels and generally in paints, alkyd resin enamels, lacquers, emulsion paints, printing inks, cement and concrete on account of its high stability, high covering power and low cost. Used in stoving finishes on account of the very high heat resistance. Also used in paper, rubber and plastics, vinyl products, linoleum and in textile printing	**101**
								Naturally occurring forms of **C.I. Pigment Red 101** having the same range of usage. They usually contain varying proportions of other minerals, especially silicates, and are milled and washed to produce the commercial products. A complete distinction between **C.I. Pigment Reds 101 and 102** is not possible. Some forms of **C.I. Pigment Red 101** are ignited **Red 102** **C.I. Pigment Reds 101** and **102, C.I. Pigment Browns 16** and **17** and **C.I. Pigment Black 11** together provide a range of hues from reddish orange through dull red and bordeaux to brown and black in pigments of similar chemical constitution (iron oxides), fastness properties and usage	**102**
Insol	V.good	Poor	Insol	Insol	Excellent	—	V.good	**Chrome Red.** Basic lead chromate The range of usage is closely similar to that of C.I. Pigment Red 104 which, however, provides a much wider range of red hues	**103**
Insol	Good	Poor	Insol	Insol	Excellent	—	V.good	Paints, alkyd resin enamels, lacquers, printing inks; also emulsion paints, rubber, plastics and vinyl products, paper surfacing and colouring, leather cloth, linoleum and textile printing **C.I. Pigment Reds 103** and **104, C.I. Pigment Orange 21** and **C.I. Pigment Yellow 34** together provide a range of hues from greenish yellow to red in pigments of closely similar chemical constitution, fastness properties and usage	**104**

Literature
Storey, *J. Oil Col. Chem. Ass.*, **15** (1932), 33 (Natural Red Iron Oxide)
Smith, *ibid.*, **20** (1937), 307
Dooley, *ibid.*, **25** (1942), 74

Standards
Natural Iron Oxides
BS 272:1952
Australia K 59
India IS 46
Ochre
BS 337:1952
Australia K 65
India IS 47
Poland PN C608
Sienna
BS 312:1952
Australia K 63
India IS 48
Burnt Umber
BS 313:1952
Australia K 64
India IS 49
Poland PN C623
Manufactured Iron Oxides
BS 305 and 851:1952
Australia K 60
India IS 45
Red Oxide of Iron
BS 370:1952
Poland PN C81020
Venetian Red
BS 370:1952
USA Fed. Spec. TT-Y-226 (1)
Blended Red Oxides of Iron
BS 694:1936
Red and Yellow Oxide of Iron Pigment for Cement
BS 1014:1942
Iron Oxide Pigments
USA ASA K 25
USA Fed Spec. TT-P-381; TT-P-375
Argentine IRAM 1015
France T31–002
Holland N882 and N883

Literature
BIOS 1402, 114
FIAT 804, Molybdate Red G, M, B, Bx
Linz, *Ind. Eng. Chem.*, **31** (1939), 298
Coffer and McCoy, *American Ink Maker*, **25** (1947) Jan, Feb, Mar, April

Standard
India IS 50

C.I. Pigment Red 105—112

C.I. Pigment Red	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
105	77578	Inorganic	—	Insoluble in organic solvents							—	— / Stable to 500
106	77766	Inorganic	—	Insoluble in organic solvents							V. good (darkens)	— / Sublimes at 446
107	77060	Inorganic	—	Insoluble in organic solvents							Excellent	546 / Blackens at 546
108	77196	Inorganic	Yellowish Red→ Bordeaux	Insoluble in organic solvents							V. good	— / Excellent to 500
109	77482	Inorganic	—	Insoluble in organic solvents							—	— / —
110	—	Disazo	Bright Yellowish Red	V. good	Good	—	Good	—	—	V. good	V. good (rubber)	— / —
111	—	Disazo	Bright Red	V. good	Good	—	Good	—	—	V. good	V. good (rubber)	— / —
112	12370	Monoazo (Pigment)	Bright Red	—	—	—	—	—	—	Fair	V. good (linseed oil)	— / Stable to 180

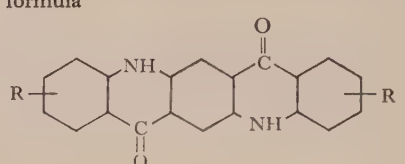
FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Red
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Insol	Unalt	Dissolves and is decomposed	Reacts	—	—	—	—	**Red Lead.** Primarily in jointing, stopping and protective paints, in oil and varnish for iron and steel and in primers for wood. Unsuitable for general paint purposes. 'Jointing Red Lead' reacts rapidly with linseed oil due to its content of litharge. 'Ordinary Red Lead' contains less litharge and reacts more slowly. Other important uses are in pottery glazes, glass manufacture and electrical accumulators. It is blackened by hydrogen sulphide	105
Insol	Unalt	V. good	Insol	—	—	—	—	**Cinabar.** Principally in rubber. Also in printing inks and occasionally lacquers, textile printing, paper, plastics and artists' colours. Natural cinnabar has been used as a pigment from the earliest times. In paints now largely replaced by organic pigments **Standards** BS 320:1938 Poland PN C 81013 **Literature** *Thorpe*, **VII**, 576	106
Insol	—	—	—		—	—	—	**Antimony Orange.** Artists' colours. Some use in hot vulcanisation of rubber. Also in pyrotechnics and safety match heads, particularly in Sweden	107
Insol	Unalt	Poor (soluble)	Insol	Insol	—	—	None	**Cadmium Red.** Paints, alkyd resin enamels, lacquers and occasionally in printing inks, paper, plastics and vinyl products and for textile printing, but it is relatively expensive and therefore confined to high quality work in which its freedom from bleeding in vehicles, resistance to light, heat, alkali and hydrogen sulphide and its freedom from toxicity are valuable, e.g. in artists' colours and special lithographic or decorative work. Also used in manufacture of ruby glass, pottery decoration and vitreous enamel work **Literature** *BIOS* 1402, 176 *FIAT* 814, 40 Ward, *J. Oil Col. Chem. Ass.*, **10** (1927), 3, 40 Curtis and Wright, *ibid.*, **37** (1954), 30	108

Note. The hue increases in redness and blueness with the proportion of selenide present. **C.I. Pigment Red 108** provides with **C.I. Pigment Red 37** and **C.I. Pigment Orange 20** a series of hues from yellow to red and bordeaux in pigments of closely similar chemical constitution, fastness properties and usage. Some Cadmium Reds may consist of C.I. 77202. **Cadmopone Reds** and **Cadmopone Crimson** are mixed pigments of **C.I. Pigment Red 108** and **C.I. Pigment White 22** and have similar properties to **C.I. Pigment Yellow 35**

								Soluble in alkalis, including ammonia, when moist; insoluble after drying See also C.I. Pigment Metal 3	**Gold Purple, Purple of Cassius.** Glass, porcelain and enamel for various shades of red **Literature**—*Thorpe*, **VI**, 122	109
Insol	Unalt	Unalt	—	—	—	No bleeding	—	Rubber and vinyl plastics. Affords high tinctorial strength		110
Insol	Unalt	Unalt	—	V. good	—	No bleeding	—	Rubber and vinyl plastics. Affords high tinctorial strength		111
V. good	V. good	—	Fair	—	—	Bleeds	—	Paints, printing inks, lacquers and inks, emulsion paints and distempers. Also paper coating, linoleum, and leather finishing		112

Standard
BS 3599/6–15: 1964 Red FGR

C.I. Pigment Red	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
113	**77201**	Inorganic	Yellowish Red→ Bordeaux	Insol	—	—	Insol	—	Insol	Insol	Excellent	— / Stable to 260
114	**12351**	Monoazo (Pigment)	Bluish Red	—	—	—	Poor	—	Poor	Poor	Good	— / Good
115	**15851**	Monoazo (Manganese salt of Acid dye)	Bordeaux	—	—	V. good	—	Slightly soluble	—	—	Excellent	— / V. good
116	—	—	—	This C.I. Generic Name is discontinued								
117	**15603**	Monoazo (Barium salt of Acid dye)	Bright Yellowish Red	Insol	Fair	—	Fair	V. good	V. good	Insol	Fair	— / V. good to 150 (lithographic varnish) slightly affected
118	—	Monoazo (Metal complex)	Dull Yellowish Red→ Maroon	5	3	—	3	—	4–5	(*Toluene*) 5	7 (as Maroon)	— / 5 120 (1 hr) 3–4 180 (20 min) (Alkyd stoving enamel)
119	—	Monoazo	Bright Yellowish Red	Insol	—	—	Insol	—	—	(*Benzene*) V. good	V. good (linseed oil)	— / Stable to 150 No sublimation
120	—	Monoazo	Red	Insol	—	—	Insol	—	—	(*Benzene*) V. good	Good (linseed oil)	— / Stable to 150 No sublimation
121	**77302**	Inorganic	Dull Bordeaux	Insoluble in organic solvents							Excellent	— / Stable to > 660
122	—	Quinacridone	Bright Bluish Red	Insol	Insol	Insol	V. good	Insol	Insol	Insol	—	— / Stable to 150 (enamel)
123	***71140*** (Similar to)	Perylene (Pigment)	—	Insol	Insol	—	Insol	—	Insol	Insol	—	— / Stable to 150
124–132				C.I. Generic Names 124–132 are discontinued								

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Red
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Insol	Unalt	Poor	Insol	Insol	—	—	None	Paints, enamels, printing inks; plastics, vinyl products, rubber, paper and textile printing	113
Insol	Unalt	Unalt	—	—	—	—	None	Printing inks, emulsion paints and in textile printing	114
Slightly soluble	—	—	V. good	—	—	—	Poor	Paints and printing inks	115
									116
V. good	Fair (yellower, weaker)	V. good	Insol	—	—	None	Bleeds	In oil media for printing inks and in plasticisers for plastics. Also in rubber, vinyl plastics and polystyrene (outstanding heat stability)	117
5	2	2	5	3	—	—	—	Primarily as a maroon shade in stoving enamels, paints and printing inks; especially suitable for production of bronze metallic effects in industrial finishes	118
Insol	Unalt	Unalt	Insol	—	—	Slight	None	Printing inks and oil varnishes	119
V. good	Fair (weaker)	Insol	Insol	—	—	Bleeds	Bleeds	Oil varnishes	120
Insol	Unalt	Unalt	—	—	—	None	—	Rubber, paper and all kinds of plastics. Also printing inks, lacquers and enamels	121
Insol	Unalt	Unalt	Insol	Insol	—	None	None	Alkyd resin enamels; NC, vinyl and acrylic lacquers; printing inks; vinyl and plastic products; textile printing **Chemical constitution**: A substituted derivative of quinacridone of general formula 	122
—	Unalt	Unalt	Insol	Insol	—	None	None	Alkyd resin enamels; NC, vinyl and acrylic lacquers; printing inks; vinyl and polyethylene plastics, mass coloration of acetate fibre; textile printing	123
									124–132

C.I. Pigment Red 133—144

C.I. Pigment Red	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
133	—	Organic (Barium salt of Acid dye)	Bluish Red	—	—	—	—	—	—	—	Excellent (PVC)	— / Stable to 170 (PVC)
134	—	Organic (Calcium salt of Acid dye)	Red	—	—	—	—	—	—	—	Excellent (PVC)	— / Stable to 150 (PVC)
135	—	Monoazo	Red	V. good	Fair	Fair	Fair	Fair	V. good	Fair	—	— / Stable to 150
136	—	Monoazo	Dull Bordeaux→ Bright Bluish Red	Insol	—	—	V. good	—	—	(*Benzene*) Fair	V. good (Linseed oil)	— / V. good
137	—	Monoazo	Dull Bordeaux	Insol	—	—	Insol	—	—	(*Benzene*) Insol	Good (Linseed oil)	— / Stable to 150 (Stoving lacquer) No sublimation
138	—	—	—	This C.I. Generic Name is discontinued								
139	—	Disazo	Red	Insol	Insol	—	Insol	—	V. good	V. good	Excellent (PVC)	— / Stable to 180 (PVC) No sublimation
140	—	Disazo	Red	Insol	Insol	—	V. good	—	V. good	V. good	V. good (PVC)	— / Stable to 180 (PVC)
141	—	Disazo	Red	Insol	V. good	—	V. good	—	V. good	V. good	V. good (PVC)	— / Stable to 180 (PVC) No sublimation
142	—	Disazo	Bluish Red	Insol	V. good	—	V. good	—	V. good	Fair	V. good (PVC)	— / Stable to 180 (PVC) No sublimation
143	—	Disazo	Red	V. good	V. good	—	Insol	—	V. good	Fair	V. good (PVC)	— / Stable to 180 (PVC) No sublimation
144	—	Disazo	Red	Insol	V. good	—	V. good	—	V. good	V. good	Excellent (Stoving enamel, acrylic lacquer or PVC)	— / Stable to 180 (Stoving enamel, acrylic lacquer or PVC)

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Red
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
V.good	—	—	—	—	—	None	None	Mass coloration of plastics (PVC, polyethylene, polystyrene) and rubber	133
V.good	—	—	—	—	—	None	None	Mass coloration of plastics (PVC, polyethylene, polystyrene) and rubber	134
Insol	V.good	V.good	Insol	V.good	—	None	None	In oil media for printing inks; in organic solvent solution of synthetic resin for lacquers **Reaction**: H_2SO_4 conc.—greenish blue; on dilution—yellowish red	135
Insol	Unalt	Unalt	V.good	—	—	—	—	In oil media for paint, varnish and transparent lacquer **Reaction**: H_2SO_4 conc.—bluish red; on dilution—reddish orange	136
Insol	Poor (weaker)	V.good	Insol	—	—	None	None	In oil media, principally for printing inks **Reaction**: H_2SO_4 conc.—reddish violet; on dilution—yellowish red	137
									138
Insol	Unalt	Unalt	Insol	—	—	None	None	Mass coloration of PVC, polyethylene and viscose	139
Insol	Unalt	Unalt	Insol	—	—	None	None	Mass coloration of PVC and polyethylene; suitable for floorings and leathercloth	140
Insol	Unalt	Unalt	V.good	—	—	Slight	None	Mass coloration of PVC and polyethylene; suitable for floorings and leathercloth	141
Insol	Unalt	Unalt	—	—	—	Slight	None	Colouring PVC sheet and leathercloth	142
Insol	Unalt	Unalt	V.good	—	—	Slight	None	Colouring PVC sheet and leathercloth	143
Insol	Unalt	Unalt	Insol	—	—	None	None	Colouring enamels, lacquers, stoving lacquers, PVC sheet and leathercloth, polyethylene	144

C.I. Pigment Red 145—163

C.I. Pigment Red	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
145	—	—	—	This C.I. Generic Name is discontinued Pigments formerly listed under it now appear under C.I. Pigment Violet 36								
146	—	Monoazo (Pigment)	Red	Insol	—	—	Insol	—	—	(*Toluene*) V. good	Good	— / Stable to 180
147	—	Monoazo (Pigment)	Bright Bluish Red	Insol	—	—	V. good	—	Fairly good	—	Moderate	— / Stable to 150 (lacquer)
148	—	Monoazo (Pigment)	Reddish Orange	V. good	—	—	Good	—	—	(*Toluene*) V. good	V. good	— / Stable to 180 (lacquer)
149	—	Organic	Red	Insol	—	—	Insol	—	—	(*Toluene*) V. good	Excellent	— / Stable to 200 (PVC)
150	—	Monoazo (Pigment)	Bluish Pink	—	—	—	Good	—	—	(*Toluene*) V. good	Good	— / Stable to 200 (PVC)
151	—	Monoazo (Barium salt of Acid dye)	Bluish Pink	V. good	—	—	V. good	—	—	(*Toluene*) V. good	V. good	— / Stable to 200 (PVC)
152	—	Monoazo (Pigment)	Red	V. good	—	—	Fair	—	Poor	Poor	—	— / Good
153	—	—	—	This C.I. Generic Name is discontinued								
154	—	Monoazo (Pigment)	Bluish Red	—	—	—	Poor	—	Poor	Poor	Good	— / Good
155	—	Monoazo (Pigment)	Bluish Red	—	—	—	Poor	—	Poor	Poor	Fair	— / Good
156	—	Monoazo (Pigment)	Bluish Red	—	—	—	Poor	—	Poor	Poor	Good	— / Good
157	—	Monoazo (Pigment)	Bluish Red	—	—	—	Poor	—	—	Poor	Good	— / Good
158	—	Monoazo (Pigment)	Bright Yellowish Red	—	—	—	Poor	—	Poor	Poor	V. good	— / Good
159	—	Monoazo (Salt of Acid dye)	Bluish Red	—	—	—	Good	—	V. good	V. good	V. good	— / Good
160	—	Monoazo (Salt of Acid dye)	Bordeaux	—	—	—	Good	—	V. good	V. good	V. good	— / Good
161	—	Monoazo (Salt of Acid dye)	Red	—	—	—	Poor	—	Fair	Good	Good	— / Good
162	12431	Monoazo (Pigment)	Yellowish Red									
163	12455	Monoazo (Pigment)	—	Insol	—	—	Fair	—	Fairly good	(*Toluene*) F. good	Good	— / Stable to 160

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Red
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
									145
Insol	Good	Good	Insol	Insol	—	—	None	Paints, lacquers and printing inks **Constitution**: The coupling component is a 3-hydroxy-2-naphthoic arylide	146
Insol	Good	—	—	V.good	—	—	Slight	Mainly for printing inks **Constitution**: The coupling component is a 3-hydroxy-2-naphthoic arylide	147
Insol	Good	—	—	V.good	—	—	Good	Mainly for printing inks; also paints and varnishes **Constitution**: The coupling component is a 3-hydroxy-2-napthoic arylide	148
Insol	V.good	V.good	—	Insol	—	None	—	Plastics such as polyethylene and PVC including those with a high plasticiser content	149
Insol	Good	Good	—	V.good	—	None	—	Mass coloration of plastics, especially PVC	150
Good	Poor	Poor	—	Insol	—	—	—	Mass coloration of plastics, especially PVC and polyethylene	151
Insol	Unalt	Unalt	—	Poor	—	—	None	Paints and printing inks; textile printing	152
									153
Insol	Unalt	Unalt	—	—	—	—	—	Printing inks and emulsion paints	154
Insol	V.good	Unalt	—	—	—	—	—	Paints and printing inks	155
Insol	Unalt	Unalt	—	—	—	—	—	Printing inks and paints; also lacquers	156
Insol	Unalt	Unalt	—	—	—	—	—	Printing inks; limited use in textile printing and in emulsion paints	157
Insol	V.good	V.good	—	—	—	—	—	Emulsion paints, lacquers, alkyd resin enamels and paints; limited use in printing inks, paper and rubber	158
Insol	Poor	Poor	—	—	—	—	—	Lacquers, paints, alkyd resin enamels and printing inks; in rubber, PVC and UF plastics	159
Insol	Poor	Poor	—	—	—	—	—	Paints, lacquers, alkyd resin enamels and printing inks; in rubber, PVC and UF plastics	160
Insol	V.good	V.good	Good	—	—	—	—	Rubber, PVC and UF plastics; also paints, printing inks and alkyd resin enamels and lacquers	161
									162
Insol	Unalt	—	Good	Good	—	—	Bleeds	Paints and printing inks	163

C.I. Pigment Red	C.I. Constitution No.	Chemical Class	Hue	FASTNESS									
				ORGANIC SOLVENTS							Light	Heat	
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C	Stability °C
164	—	Disazo	Dull Yellowish Red	Insol	—	—	Insol	—	Insol	Insol	V. good (Paint)	—	Good (Stoving lacquer)
165	—	Disazo	Bluish Red	V. good	V. good	—	V. good	—	V. good	V. good	Excellent (PVC)	—	Stable to 180 (PVC)
166	—	Azo	Yellowish Red	Insol	Insol	—	Insol	—	Insol	Insol	Excellent	—	Stable to 150 (Lithographic varnish)
167	—	Anthraquinone	Bordeaux	—	—	—	—	—	—	—	7	—	—
168	59300	Anthraquinone	Bright Yellowish Red	Good	—	Fair	Fair	Fair	Fair	Fair	Excellent (Full strength) (Nitro alkyd resin) Good (tint)	—	Good to 400 V. good to 180
169	45160:2	Copper ferrocyanide complex of Basic dye	Bright Bluish Pink	5	—	3	3	3	—	(*Benzene*) 5	4	—	5 (tin print)
170	—	Monoazo	Bluish Red	5	—	—	4–5	—	5	(*Benzene*) 4	6–7	—	Stable to 160
171	—	Monoazo	Bordeaux	5	—	4–5	4–5	—	Insol	(*Benzene*) 4–5	7	—	Stable to 280 (Polythene, polystyrene)
172	45430:1	Phthalein (Aluminium salt of Acid dye)	Red	—	—	—	—	—	—	—	—	—	—
173	45170:3	Xanthene (Aluminium salt of Basic dye)	Red	—	—	—	—	—	—	—	—	—	—
174	45410:2	Phthalein (Aluminium salt of Acid dye)	Red	—	—	—	—	—	—	—	—	—	—
175	—	Monoazo (Pigment)	Red→ Bluish Red	5	—	4–5	4–5	4–5	Good	(*Benzene*) 5	8 (Alkyd, melamine resin) 7–8 (Soft PVC)	—	Stable to 200 (30 min) (Polythene, polystyrene)

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Red
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Insol	Insol	Insol	Insol	—	—	None	None	Plastics	164
Insol	Unalt	Unalt	Insol	—	—	None	None	Mainly PVC; also polyolefins, paints, printing inks, stoving enamels and lacquers	165
Insol	Unalt	Unalt	Insol	Insol	—	None	None	Plastics, paints and printing inks	166
—	—	—	—	—	—	—	—	Mass pigmentation of viscose. No dichroic effect. Fastness to acids, alkalies, perspiration, soda boil, washing and water: 5	167
Insol	Good	Good	—	Good	—	—	Good	Industrial, automotive and architectural paints, printing inks and vinyl plastic **Textiles**: See C.I. Vat Orange 3	168
3	—	—	3	—	—	—	1	Printing inks. Compared with PTMA salt (C.I. Pigment Red 81) somewhat inferior in fastness properties but somewhat less expensive The parent dye is C.I. Basic Red 1	169
5	5	5	—	—	—	—	5	Printing inks and lacquers	170
5	—	Unalt	—	—	—	None	None	PVC, inks and lacquers	171
—	—	—	—	—	—	—	—	Cosmetics The parent dye is C.I. Acid Red 51	172
—	—	—	—	—	—	—	—	Cosmetics The parent dye is C.I. Basic Violet 10	173
—	—	—	—	—	—	—	—	Cosmetics The parent dye is C.I. Acid Red 92	174
5	—	—	5	—	—	None	—	Paints, lacquers, PVC, polythene, polystyrene	175

C.I. Pigment Red 176—191

C.I. Pigment Red	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C	Stability °C
176	—	Monoazo (Pigment)	Bluish Red	5	—	4–5	4–5	4	5	(*Benzene*) 5	6 ($\frac{1}{3}$ strength)	—	Stable to 300 (polythene) 320 (polystyrene)
177	—	Anthraquinone	Red	Insol	V. good	—	Insol	—	V. good	Insol	Excellent (PVC, alkyd)	—	Stable to 300 (alkyd-melamine)
178	—	Perylene	Red	Insol	Insol	—	Insol	—	Insol	Insol	6–8	—	—
179	71130	Perylene (Pigment)	Dull Red	Good	—	—	Good	—	Good	Good	Good (Full strength)	—	—
180	—	Isoindolinone	Red	—	—	—	—	—	—	—	7–8	—	Excellent
181	73360	Indigoid (Pigment)	Bright Yellowish Red	—	—	—	—	—	—	—	—	—	—
182	—	Anthraquinone	Red	—	—	Insol	Insol	—	—	(*Toluene*) Insol	7–8 (Full strength)	—	Stable to 180
183	—	Monoazo	Bluish Red	—	—	4–5	4–5	4–5	—	(*Toluene*) Insol	7–8	—	—
184	—	Monoazo	Bluish Red	—	—	4	5	3–4	4–5	(*Toluene*) 4	—	—	—
185	—	Monoazo	Bluish Red	5	—	4–5	(*Methanol*) 4–5	4–5	—	(*Toluene*) 5	6–7 (Alkyd/melamine) Mass tone 6 (Letterpress printing)	—	—
186	—	Monoazo	Red	5	—	4–5	4–5	4–5	—	(*Toluene*) 5	7–8	—	—
187	—	Monoazo	Bluish Red	4–5	—	4	4–5	3	—	(*Benzene*) 4	4–5 (Letterpress printing)	—	—
188	—	Monoazo (Pigment)	Yellowish Red	5	—	4	4—5	3	—	(*Benzene*) 4	7	—	—
189	—	Anthraquinone	Red										
190	71140	Perylene (Pigment)	Red	Good	—	—	Good	—	Good	Good	Good (Exterior full and tint strengths)	—	—
191	45425:2	Xanthene	Yellowish Red	Poor	V. good	Poor	V. good	—	—	Poor	Fair (Oil)	—	—

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Red
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
5	—	—	—	—	5	None	None	PVC, polythene, polystyrene, NC lacquers, alkyd/melamine stoving lacquers, inks for letterpress and tinplate printing	176
Insol	Unalt	Unalt	Insol	Insol	—	None	None	Cellulose ester and synthetic resin and other lacquers, paints; mass colouration of plastics. Has high tinctorial strength	177
Insol	Unalt	Unalt	Insol	Insol	—	4–5	—	Lacquers, most thermoplastics, paints	178
Insol	—	Good	—	Good	—	—	—	Industrial, automotive and architectural paints, printing ink, vinyl and polyolefin plastics **Textiles**: See C.I. Vat Red 23	179
—	—	—	—	—	—	—	—	Paints of most types	180
—	—	—	—	—	—	—	—	Paints, printing inks, plastics **Textiles:** See C.I. Vat Red 1	181
—	V.good	V.good	Insol	—	5	—	V.good	NC and alkyd lacquers, varnishes. Useful for shading inorganic pigments	182
5	5	5	4–5	—	5	—	—	Paints, lacquers, PVC, polythene, polystyrene	183
5	5	5	5	—	4–5	—	5	Paints, lacquers, polyethene, polystyrene	184
5	5	5	5	—	5	—	5	PVC, polythene, polystyrene, NC lacquers, alkyd/melamine stoving lacquers, inks for letterpress and tinplate printing	185
5	—	—	5	—	5	—	—	PVC, polythene, polystyrene	186
5	—	—	—	3–4	4–5	—	—	PVC, polythene, polystyrene, NC lacquers, inks for letterpress printing	187
5	5	5	5	—	4–5	—	—	PVC, polythene, polystyrene, lacquers and printing inks	188
								Textiles: See C.I. Vat Red 32	189
Insol	Good	Good	—	Good	—	—	—	Industrial, automotive, architectural paints, printing inks, vinyl and polyolefin plastics **Textiles**: See C.I. Vat Red 29	190
V.good	Good (redder)	F.good	V.good	—	—	—	—	Cosmetics	191

C.I. Pigment Red 192—201

C.I. Pigment Red	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
192	—	Quinacridone	Bluish Red	—	—	—	—	—	—	—	8	— / Stable to 180 (15 min)
193	16185	Monoazo (Aluminium salt of Acid dye)	Bluish Red	Insol	V. good	V. good	V. good	—	—	Insol	Fair (Oil)	— / —
194	71100	Anthraquinone	Dull Red	—	—	—	—	—	—	—	—	— / —
195	70320	Anthraquinone	Bluish Red	V. good	—	—	V. good	—	V. good	V. good	V. good	— / —
196	67000	Anthraquinone	Bluish Red	V. good	—	—	V. good	—	V. good	Poor	V. good	— / Good
197				This C.I. Generic Name is discontinued								
198	73390	Indigoid	Reddish Violet	Good	—	—	Good	—	Good	—	Good Exterior full strength and tints	— / —
199	—	Monoazo	Bluish Red	5	—	4–5	5	4–5	—	*Toluene* 5	7 (PVC)	— / 200 (30 min) alkyd melamine stoving enamel
200	15867	Monoazo (Calcium salt of Acid dye)	Bright Bluish Red	Good	—	—	Fair	—	—	Fair	—	— / Good
201	—	Monoazo (Metal salt of Acid dye)	Bright Bluish Bordeaux	Excellent	—	—	Poor–Fair	—	—	—	—	— / —

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Red
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
—	—	—	—	—	—	—	—	Alkyd resin enamels; lacquers; printing inks	192
good	V.good	Good	Poor	—	—	—	—	Cosmetics	193
—	—	—	—	—	—	—	—	Alkyd resin enamels, lacquers and plastics **Textiles**: See C.I. Vat Red 15	194
V.good	V.good	V.good	—	V.good	—	—	—	Alkyd resin enamels, lacquers and plastics **Textiles**: See C.I. Vat Red 13	195
V.good	V.good	V.good	—	V.good	—	—	—	Alkyd resin enamels, lacquers and printing inks **Textiles**: See C.I. Vat Red 10	196
									197
Good	Good	Good	—	Good	—	—	—	Industrial, automotive and architectural paints, printing inks, vinyl and polyolefin plastics **Textiles**: formerly used as vat dye	198
5	5	5	5	—	4–5	5	—	Printing inks, transparent lacquers, PVC	199
Good	V.good	Fair	—	—	—	—	Poor	Printing inks (offset, flexographic and rotogravure), paints and plastics	200
Good	Fair	Good–fair	—	—	—	—	Poor	Flexographic, NC rotogravure and glycol based inks	201

C.I. Pigment Violet	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
1	45170:2	Xanthene (PTMA* salt of Basic dye)	Bright Reddish Violet	4–5	1	4	1	1	1	3	6–7 (Full strength) 3 (⅓ strength)	— / 4–5 120 (1 hr)
2	45175:1	Xanthene (PTMA* salt of Basic dye)	Bright Reddish Violet	5	1	3–4	1	1	1	4	5 (Full strength) 2–3 (⅓ strength)	— / 4–5 120 (1 hr)
3	42535:2	Triphenylmethane (PTMA* salt of Basic dye)	Bright Bluish Violet	5	1	4–5	1	1	1	4–5	5 (Full strength) 3 (⅓ strength)	— / 4–5 120 (1 hr)
4	42510:2	Triphenylmethane (PTMA* salt of Basic dye)	Bright Reddish Violet	Insol	—	—	Poor	—	Poor	Poor	Fair	— / Good
5	58055	Anthraquinone (Sodium salt of Acid dye)		—	—	—	—	—	—	—	—	— / —
5:1	58055:1	Anthraquinone (Aluminium salt of Acid dye)	Bright Reddish Violet	5	4	5	5	4–5	4–5	5	V.good	— / —
6	58060	Anthraquinone (Sodium salt of Acid dye)	—	—	—	—	—	—	—	—	—	— / —
6:1	58060:1	Anthraquinone (Aluminium salt of Acid dye)	Bright Reddish Violet	—	Insol	—	Insol	—	Insol	Insol	V.good	— / Stable to 120

*Phosphotungstomolybdic acid. Some of the brands listed may be PMA (phosphomolybdic acid) or PTA (phosphotungstic acid) salts

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Violet
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
4	2	4–5	3–4	3–4	2–4	—	1	Primarily in printing inks. Provides a combination of high tinctorial strength, inherent purity of shade, good acid resistance, and freedom from bleeding in oils. Used also in paints where vividness of shade is the predominant factor, inks for wrapper and tinplate printing, paper coating and staining and crayons and chalks. Occasionally used in alkyd resin enamel, lacquers, emulsion paints, rubber (cold cure), plastics, vinyl products and in textile printing **Constitution**: In some brands C.I.45170 (C.I. Basic Violet 10) may be replaced in part by other closely related xanthene dyes	**1**
								Discoverers—C. Immerheiser and B. Zschimmer, 1925; P. Rabe 1926 **Literature** I.G., *BP* 265032; *FP* 608301; *GP* 449539 (*Fr.* **15,** 1815); *BP* 292253, 294286; *USP* 1736835; *GP* 503811 (*Fr.* **17,** 1506)	
3–4	2	4–5	4–5	4–5	2–5	—	1	Usage and properties similar to those of C.I. Pigment Violet 1. The parent dye is C.I. Basic Violet 11 **Literature** Discoverers and Patents as for C.I. Pigment Violet 1 *BIOS* 961, 27 *BIOS* 1661, 16, 35 *FIAT* 764—Fanalrot 6B Supra Plv.	**2**
5	4	4	5	5	2–5	—	1	Usage as for C.I. Pigment Violet 1. The parent dye is C.I. Basic Violet 1 **Literature** Discoverers and Patents as for C.I. Pigment Violet 1 *BIOS* 961, 27 *BIOS* 1661, 16, 39 *FIAT* 764—Fanalviolett R Supra Plv.	**3**
Insol	Poor	V. good	—	—	—	—	Severe	Primarily used in printing inks The parent dye is C.I. Basic Violet 14	**4**
—	—	—	—	—	—	—	—	Used for manufacture of Aluminium salt (C.I. Pigment Violet 5:1)	**5**
4–5	1	2	4	4	5	—	1	Lacquers; also paints, alkyd resin enamels, printing inks, wallpapers and leather finishes. Occasionally emulsion paints, rubber, vinyl products, plastics and textile printing	**5:1**
—	—	—	—	—	—	—	—	Used for manufacture of Aluminium salt (C.I. Pigment Violet 6:1)	**6**
Insol	Poor	Good	Insol	Insol	—	—	Slight	Primarily lacquers, on account of fastness to most solvents; occasionally paints, printing inks, rubber and plastics	**6:1**

C.I. Pigment Violet 7—17

C.I. Pigment Violet	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	Cellosolve	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
7	58065	Anthraquinone (Sodium salt of Acid dye)	—	—	—	—	—	—	—	—	—	— / —
7:1	58065:1	Anthraquinone (Aluminium salt of Acid dye)	Bright Bluish Violet	—	Insol	—	Insol	—	Insol	Insol	V. good	— / Stable to 120
8	18005:1	Monoazo (Barium salt of Acid dye)	Bluish Violet	—	—	—	—	—	—	—	Fair	— / Stable to vulcanisation No sublimation
9	—	PTA salt of Basic dye	Bluish Violet	V. good	—	—	—	—	Poor	—	Fair	— / —
10	—	—	—	This C.I. Generic Name is discontinued. All information formerly listed under this name now appears under C.I. Pigment Violet 3								
11	—	Complex inorganic salt of Basic dye	Bright Violet	—	Poor	—	Poor	—	Poor	Insol	Good	— / Good
12	58050:1	Anthraquinone (Aluminium derivative)	Violet	Good	—	—	Poor	—	Poor	Poor	Good	— / —
13	—	Organic	Violet	Good fastness to organic solvents							Fair	— / Stable to 180
14	77360	Inorganic	Violet	Insoluble in organic solvents							Excellent	— / Stable to 700
15	*77007* see note	Inorganic	Violet	Insolube in organic solvents							7–8	— / Excellent
16	77742	Inorganic	Violet	—	—	—	—	—	—	—	Excellent	— / Heat sensitive
17	—	Monoazo	Dull Reddish Violet	Insol	—	—	Insol	—	—	(*Benzene*) Insol	V. good (Linseed oil)	— / Stable to 150 No sublimation

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Violet
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
—	—	—	—	—	—	—	—	For manufacture of the aluminium salt for use as a pigment (C.I. Pigment Violet 7:1)	7
Insol	Poor	Good	Insol	Insol	—	—	Slight	Primarily lacquers, on account of fastness to most solvents; occasionally paints	7:1
Insol	Unalt	Unalt	—	—	—	—	—	Rubber and synthetic rubbers. Semi-transparent, high tinctorial value, unaffected by ageing and fast to pressure vulcanisation. Non-bleeding in rubber **Textiles**: The sodium salt is C.I. Acid Violet 67	8
V.good	V.good	V.good	—	V.good	—	—	—	Emulsion paints, textile printing, printing inks and rubber. Occasionally paints, alkyd resin enamels, lacquers, paper and plastics	9
									10
Insol	Good	Unalt	Insol	Insol	—	—	Bleeds	Printing inks and emulsion paints and distempers; also copying papers	11
Insol	Unalt	Good	—	Good	—	—	—	Alkyd resin enamels and lacquers; occasionally paints, printing inks, rubber and plastics	12
V.good	V.good	V.good	V.good	—	—	—	—	Printing inks, paper and wallpaper. When the highest fastness to solvents and to light is not required, in paints, varnishes and plastics	13
Insol	Unalt	Unalt	Insol	Insol	—	—	None	**Cobalt Violet.** Ceramics and glass and as an artists' colour; some use in stoving enamels and in rubber, plastics and paper when exceptional fastness is required	14
Insol	Unalt	Poor	—	—	—	—	—	**Ultramarine Violet.** Used in distemper and lime colour. Tinctorial value low **Literature** *BIOS* 1402, 1 Van Wüllen Scholten, Pigment Tabellen *Wagner*, p.152 *Note.* Commercial products may be mixtures of **C.I. Pigment Blue 29** and **Ultramarine Red** (see **C.I. 77007**)	15
—	Destroyed	—	—	—	—	—	—	**Manganese Violet.** Heat sensitive and indicating paints and crayons **Literature** *BIOS* 1402, 148 *Wagner*, p.201	16
Insol	Unalt	Unalt	Insol	—	—	Slight	None	In oil media for paints and varnishes	17

C.I. Pigment Violet 18—32

C.I. Pigment Violet	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
18	—	Inorganic	Violet	Insoluble in organic solvents							Excellent	— / Stable to > 660
19	46500	Quinacridone	Bright Violet	Insol	Insol	Insol	Insol	Insol	Insol	Insol	—	— / Stable to 165 (Stoving enamel)
20	58225	Anthraquinone (Calcium salt of Acid dye)	Bright Reddish Violet	V. good	Good	—	Good	V. good	V. good	V. good	V. good (Full strength and tint)	— / Slightly affected at 150 (Lithographic varnish)
21,22				These two C.I. Generic Names are discontinued								
23	51319	Dioxazine	Bluish Violet	5	3	4	4	3	3	3	7–8 (Full strength) 6–7 ($\frac{1}{3}$ strength)	— / 4 to 150 30 min
24	—	—	—	This C.I. Generic Name is discontinued								
25	12321	Monoazo (Pigment)	Bright Violet	—	—	—	Poor	—	Poor	Poor	V. good	— / Good
26	*58225* (similar)	Anthraquinone (Heavy metal salt)	Reddish Violet	V. good	—	—	V. good	—	V. good	V. good	—	— / Fair (Stoving lacquer)
27	42535:3	Triarylmethane (Copper ferrocyanide complex)	Violet	5	—	4	4	3	—	(*Benzene*) 5	—	— / 5 (Tin print)
28	—	Triphenylmethane	Violet	5	—	5	(*Methanol*) 1	2	—	(*Benzene*) 5	5	— / —
29	—	Anthraquinone (Pigment)	Violet	5	—	5	(*Methanol*) 1	5	—	(*Benzene*) 4–5	—	— / Stable to 230 (PVC)
30	—	Quinacridone (Pigment)	Bright Reddish Violet	Insol	Insol	—	Insol	—	Insol	Insol	Excellent	— / Stable to 200 (Stoving enamel)
31	60010	Anthraquinone (Pigment)	Bluish Violet	—	—	—	Insol	Insol	—	V. good	—	— / —
32	—	Monoazo (Pigment)	Reddish Violet	5	—	4–5	4	4	5	(*Benzene*) 4–5	—	— / Stable to 200 (PVC)

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Violet
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Insol	Unalt	Unalt	—	—	—	None	—	Rubber, paper and all kinds of plastics. Also printing inks, lacquers and enamels **Chemical constitution:** a cobalt silicate related to C.I. 77365	18
Insol	Unalt	Unalt	Insol	Insol	—	None	None	Alkyd resin enamels; NC, vinyl and acrylic lacquers; vinyl and other plastics and textile emulsion inks **Literature:** *See* C.I. 46500	19
Insol	Good	Good	Insol	Excellent	V.good	None	None	Industrial paints, rubber and plastics	20
									21,22
5	5	5	5	5	5	None	5	In oil media for paints and printing inks; in organic solvent solution for synthetic resin lacquers. Emulsion paints, plastics, linoleum, rubber, leather finishing, inks and artists' colours and mass coloration of viscose	23
									24
Insol	Unalt	Unalt	Poor	—	—	—	None	Primarily printing inks. Occasionally in textile printing and in emulsion paints	25
Insol	Poor	Poor	V.good	—	—	Bleeds	Bleeds	Primarily printing inks	26
4	($\frac{NaOH\,1\%}{2}$)	—	5	—	—	—	1	Printing inks. Less costly but inferior in fastness to **C.I. Pigment Violet 3**. The parent dye is C.I. Basic Violet 1	27
5	Good	—	—	4	—	—	Slight	Printing inks, giving a bronze reflex **Constitution: Alkali Blue** free sulphonic acid	28
5	—	—	—	5	—	None	—	PVC coloration	29
Insol	Unalt	Unalt	Insol	Insol	—	None	None	In organic solvent and aqueous media for stoving enamels, paints, printing inks and all plastics	30
Insol	—	—	—	—	—	—	—		31
5	5	$\frac{H_2SO_4}{5}$	—	—	—	Slight	Slight	**Textile dyeing**: *See* C.I. Vat Violet 1 PVC (soft and rigid films, extrusions, leather cloth); PVC, polystyrene and polyethylene (injection mouldings). Printing inks, stoving enamels, paints	32

C.I. Pigment Violet 33—39

C.I. Pigment Violet	C.I. Constitution No.	Chemical Class	Hue	FASTNESS									
				ORGANIC SOLVENTS							Light	Heat	
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C	Stability °C
33	60005	Anthra-quinone	Bluish Violet	—	—	—	—	—	—	—	—	—	—
34	—	Dioxazine	Reddish Violet	—	—	—	—	—	—	—	8	—	5
35	—	Dioxazine	Bluish Violet	—	—	—	—	—	—	—	8	—	5
36	73385	Indigoid (Pigment)	Reddish Violet	V.good	Poor	—	V.good	—	Poor	Fair	V.good (full str'gth, stoving enamel)	—	Stable to 150 (alkyd melamine)
37	—	Dioxazine	Bluish Violet	—	4	—	4–5	4–5	—	5	8	—	5 (180 pvc 30 min)
38	73395	Indigoid	Bright Reddish Violet	Good	—	—	Fair	—	Poor	Poor	Good (Exterior full shade) Poor (Exterior tint shade)	—	—
39	42555:2	Tri-phenyl-methane (PMA salt of Basic dye)	Bright Violet	Insol	Poor	—	Poor	—	Poor	Insol	Good	—	—

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Violet
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
—	—	—	—	—	—	—	—	**Textile dyeing**: *See* C.I. Vat Violet 9	**33**
—	—	—	—	—	—	—	—	Paints of most types	**34**
—	—	—	—	—	—	—	—	Paints of most types	**35**
Insol	Unalt	Unalt	Insol	—	—	Bleeds	None	**Textile dyeing**: *See* C.I. Vat Violet 2	**36**
5	—	—	—	—	5	5	—	Plastics, printing inks and paints	**37**
Insol	Good	Good	—	Fair	—	—	—	Architectural paint and printing ink **Textile dyeing**: *see* C.I Vat Violet 3	**38**
Insol	Fair (slightly bluer)	Fair (weaker)	V. good	Insol	—	—	Bleeds	Printing inks in oil media The parent dye is C.I. Basic Violet 3	**39**

C.I. Pigment Blue 1—10

C.I. Pigment Blue	C.I. Constitution No.	Chemical Class	Hue	FASTNESS									
				ORGANIC SOLVENTS							Light	Heat	
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C	Stability °C
1	42595:2	Triphenylmethane (PTMA* salt of Basic dye)	Bright Reddish Blue	5	1	3	1	1	1	3	5 (Full strength) 3 (⅓ strength)	—	4 to 150 30 min
2	44045:2	Triphenylmethane (PTMA* salt of Basic dye)	Bright Blue	Insol	Poor	—	Poor	—	Good	Insol	Good–v. good	—	Stable to 150
3	42140:1	Triphenylmethane (PTMA* salt of Basic dye)	Bright Blue	Insol	Poor	—	Poor	—	Poor–fair	V. good	Good	—	Stable to 150 Marked change >150
4	—	PTMA salt of Basic dye	Bright Blue	—	—	—	—	—	—	—	V. good	—	—
5	—	PTMA* salt of Basic dye	Bright Reddish Blue	—	—	—	—	—	—	—	V. good–excellent	—	—
6	—	PTA* salt of Basic dye	Greenish Blue	Insol	—	—	—	—	Poor	—	Fair	—	—
7	—	Complex salt	Bright Blue	—	—	—	Poor	—	—	—	Poor	—	Stable to 150
8	42140:1 42040:1	PTMA* salt of mixed Basic dyes	Bright Greenish Blue	—	Poor	—	Poor	—	Poor	Insol	Good–v. good	—	Good to 150
9	42025:1	Triphenylmethane (PTMA* salt of Basic dye)	Bright Greenish Blue	Insol	Poor	—	Poor	—	Poor	Fair–good	Good	—	Stable to 150
10	44040:2	Triphenylmethane (PTMA* salt of Basic dye)	Bright Reddish Blue	Fastness properties closely similar to those of C.I. Pigment Blue 1								—	Very good

*Phosphotungstomolybdic acid. Some brands are PTA (phosphotungstic acid) or PMA (phosphomolybdic acid) salts

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Blue
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
5	4	4–5	3–4	3	1–4	—	1	Primarily for printing inks on account of its exceptional brightness, clean tone and high tinctorial value. Occasionally paints, alkyd resin enamels, emulsion paints (only when the medium is not highly alkaline) and plastics (U/F and P/F). Also paper coating, wallpapers, leather finishes book cloth, carbon papers and typewriter ribbons, artists' colours *Discoverers*: C. Immerheiser and B. Zschimmer 1925; P. Rabe 1926	1
				Literature I.G., *BP* 265032, *FP* 608301; *GP* 449539 (*Fr.* **15**, 1815); *BP* 292253, 294286; *USP* 1736835; *GP* 503811 (*Fr.* **17**, 1506) *BIOS* 961, 27 *BIOS* 1661, 19 *FIAT* 764—Fanalblau B Supra Plv. The parent dye is C.I. Basic Blue 7					
Insol	Fairly good	Good	Insol	Good	—	—	Bleeds	Usage, discoverers and literature as for C.I. Pigment Blue 1 The parent dye is C.I. Basic Blue 26	2
Insol	Good	Good	V.good	V.good	—	—	Bleeds	Usage, discoverers and patents as for C.I. Pigment Blue 1 The parent dye is C.I. Basic Blue 5	3
Insol	—	—	—	—	—	—	—	Dispersed pigment for paper (beater dyeing and coating); occasionally on wallpaper	4
Excellent	—	—	—	—	—	—	—	Dispersed pigment for paper (beater dyeing and coating); occasionally on wallpaper	5
V.good	V.good	—	—	V.good	—	—	—	Printing inks, emulsion paints and textile printing; occasionally paints, alkyd resin enamels, lacquers and papers	6
Insol	—	Poor	Insol	—	—	—	Slight	Printing inks of brilliant hue and high transparency. Also paper coating; tinplate printing, PVC and rubber **Chemical constitution**: Complex formed of barium and PTMA salts of dye containing an acid and a basic group	7
Insol	F.good	V.good	V.good	V.good	—	—	Bleeds	Usage as for C.I. Pigment Blue 1	8
Insol	V.good	V.good	Insol	Insol	—	—	Severe	Mainly printing inks and otherwise as for C.I. Pigment Blue 1 The parent dye is C.I. Basic Blue 1	9
—	—	—	—	—	—	—	—	Wrapper printing (excellent fastness to paraffin wax) and tinplate printing and otherwise as for C.I. Pigment Blue 1	10

C.I. Pigment Blue 11—15:2

C.I. Pigment Blue	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
11	44040:2	Triphenylmethane (PTA* salt of Basic dye)	Reddish Blue	—	—	—	—	—	—	Insol	Good	— / Good
12	42130	Triarylmethane (PTA* salt of Basic dye)	Bright Blue	Insol	—	—	Poor	—	Good	Poor	Good	— / Fair
13	—	PTA* salt of Basic dye	Blue	Insol	—	—	—	—	Poor	—	Fair	— / —
14	42600:1	Triphenylmethane (PMA* or PTA* salts of Basic dye)	Bright Reddish Blue	—	—	—	—	—	—	—	Fair	— / Good
15	74160 (α-form)	Phthalocyanine: Copper complex (Pigment)	Bright Blue	5	4–5	5	5	5	4–5	5	7–8 (Full strength) 7–8 ⅓ strength (Printing ink)	— / 4–5 150 30 min
15:1	74160 (α-form)	Phthalocyanine: Copper complex (Pigment)	Bright Blue	5	4–5	5	5	4–5	4–5	4–5	7–8 (Full strength) 7–8 ⅓ strength (Printing ink)	— / 4–5 150 30 min
15:2	74160 (α-form)	Phthalocyanine: Copper complex (Pigment)	Bright Blue	5	4–5	5	5	4–5	4–5	4–5	7–8 (Full strength) 7–8 ⅓ strength (Printing ink)	— / 4–5 150 30 min

*PTA=phosphotungsic acid; PMA=phosphomolybdic acid

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Blue
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Good	Poor	—	—	—	—	—	Severe	Rubber. Occasionally plastics and vinyl products	**11**
Insol	Poor	Good	—	—	—	—	Severe	Principally in printing inks	**12**
Insol	—	—	—	—	V.good	—	—	Printing inks, emulsion paints, textile printing and rubber. Occasionally paints, lacquers, paper, plastics, vinyl products	**13**
Insol	V.good	V.good	—	—	—	—	None	Paper colouring, for which purpose it is specially dispersed The parent dye is C.I. Basic Violet 4	**14**
5	5	5	5	5	5	—	5	Copper phthalocyanine is the most widely used of all blue pigments—possibly of all organic pigments. Five distinct commercial types can be distinguished and **C.I. Pigment Blue 15** has now been subdivided to accommodate them. The basis of the classification is set out in the note opposite Copper phthalocyanine is used in almost all pigment applications on account of its high fastness to most agencies and especially for paints, alkyd resin enamels, printing inks, lacquers and emulsion paints and distempers. Also used in rubber (high stability to vulcanisation, freedom from bleeding and without effect on ageing), PVC and plastics, linoleum, leather cloth, paper and wallpaper, tinplate printing, artists' materials, wax compositions and cements; in textile printing and for mass pigmentation of viscose **Literature** Haddock, *JSDC*, **61** (1945), 68 Brouillard, *An. Ink Maker*, **32** (1954), (i) 32, (iii) 30, 65 Inman, *Organic Pigments*, R.I.C. Monograph 1967, No. 1	**15**
5	5	5	5	5	5	—	5	Especially suitable for paints and lacquers, rotogravure and other inks containing organic solvents. See note 2 above	**15:1**
5	5	5	4–5	5	4–5	—	5	Especially suitable for all types of paint, lacquer and gravure inks. See note 3 above	**15:2**

Notes—**Variations in physical form of copper phthalocyanine**

1. Copper phthalocyanine exists in two modifications generally referred to as α and β. The α-form is relatively unstable physically and in certain solvents changes into a coarsely crystalline form of no tinctorial value—a defect known as 'can fading'—which makes this modification unsuitable for paints. This form is here listed as **C.I. Pigment Blue 15**
2. The α-form can be rendered solvent stable by the minor modification of introducing a small amount of chlorine into the molecule. This solvent stable α-form is here listed as **C.I. Pigment Blue 15:1**
3. Both α- and β-forms have a tendency to flocculate, i.e. to separate from white pigments when used in paints and lacquers but the tendency can be overcome by special treatment. The α-form, solvent stable and treated to prevent flocculation, is here listed as **C.I. Pigment Blue 15:2**
4. The β-form of copper phthalocyanine is the more stable form and is solvent stable. This is listed here as **C.I. Pigment Blue 15:3**
5. The β-form specially treated to overcome the flocculation tendency is listed here as **C.I. Pigment Blue 15:4**

Standard
BS 3599/6–15: 1964 Copper phthalocyanine

C.I. Pigment Blue 15:3—21

C.I. Pigment Blue	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
15:3	**74160** (β-form)	Phthalocyanine: Copper complex (Pigment)	Bright Blue	5	4–5	5	5	4–5	4–5	5	7–8 (Full strength) 7–8 ⅓ strength (Printing ink)	— / 4–5 150 30 min
15:4	**74160** (β-form)	Phthalocyanine: Copper complex (Pigment)	Bright Blue	As for C.I. Pigment Blue 15:3								
16	**74100**	Phthalocyanine (Pigment)	Bright Greenish Blue	3–4	2	1	4	4	1	1	7–8 (Full strength) 7–8 ⅓ strength (Printing ink)	— / 3 150
17	**74180 74200**	Phthalocyanine (Sodium salt of Direct dye)		—	—	—	—	—	—	—	—	— / —
17:1	**74180:1 74200:1**	Phthalocyanine (Barium salt of Direct dye)	Bright Greenish Blue	—	—	—	Insol	—	Insol	—	V. good	— / Stable to 100
18	**42770:1**	Triarylmethane (Pigment)	Bright Blue →Bright Reddish Navy	Insol	Poor	—	Poor	—	Poor	Good	Fair–good	— / Good
19	**42750:1**	Triarylmethane (Pigment)	Bright Blue →Bright Reddish Navy	As for C.I. Pigment Blue 18								
20	—	Organic (Pigment)	Bright Navy	—	V. good	—	Poor	—	—	V. good	Good	— / Stable to 150
21	**69835**	Anthraquinone (Pigment)	Reddish Navy	V. good	—	—	V. good	—	Poor	V. good	V. good	— / —

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Blue
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
5	5	5	5	5	5	—	5	Somewhat greener and brighter than C.I. Pigment Blues 15, 15:1 and 15:2. Especially valuable for cyan blue process inks of maximum brightness. See note 4 page 3345	**15:3**
As for C.I. Pigment Blue 15:3								As for C.I. Pigment Blue 15:3. See note 5 page 3345	**15:4**
5	5	5	4	4	3–4	—	5	Printing inks, emulsion paints and distempers, paper coating, wallpaper and linoleum; polythene, cellulose acetate and nitrate, polystyrene, PVC, U/F and P/F plastics. Also artists' colours, wax compositions and cements for interior use. There is some tendency to crystalise with resultant change in shade and strength in contact with certain organic solvents	**16**
		Literature Haddock, *JSDC*, **61** (1945), 68 Brouillard, *Am. Ink Maker*, **32** (1954), (i) 32, (iii) 30, 65							
—	—	—	—	—	—	—	—	For manufacture of Barium salt (C.I. Pigment Blue 17:1) **Textiles**: C.I. Direct Blues 86 and 87	**17**
Insol	V.good	V.good	Insol	—	—	—	—	Printing inks fast to spirit varnishing, NC lacquers, water paints and distempers, wallpaper, paper coating and leathercloth Used also in the manufacture of green pigments by striking the barium salt on a yellow pigment. (*See* C.I. Pigment Green 13)	**17:1**
Insol	Fair	Unalt	V.good	V.good	—	—	Slight	Mainly printing inks—has high tinctorial strength and lustrous bronze top tone. Also in paper staining and dyeing, copying papers and typewriter ribbons. Occasionally in plastics, PVC and rubber (not fast to severe vulcanisation) **Constitution**: Acid form of C.I. Acid Blue 48	**18**
As for C.I. Pigment Blue 18								Usage as for C.I. Pigment Blue 18 but hue is somewhat bluer **Constitution**: Acid form of C.I. Acid Blue 110	**19**
Insol	Unalt	Unalt	V.good	—	—	—	Slight	Rubber, plastics (PVC, U/F, P/F, cellulose acetate and NC) and mass colouration of viscose rayon	**20**
Insol	Unalt	Unalt	—	Insol	—	—	—	Alkyd resin enamels and lacquers; occasionally printing inks Formerly used as a vat dye. Application method AQ/1 (vatting and dye not above 50°). Light fastness and chlorine fastness good	**21**

C.I. Pigment Blue 22—28

C.I. Pigment Blue	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
22	69810	Anthraquinone (Pigment)	Reddish Navy	—	—	Good	Fair	Fair	—	Slight bleeding (*Toluene*) Fair	Excellent (Exterior full strength and tint)	— / Good to 400
23	—	Organic	Blue	Good to moderate fastness to solvents							Fair	— / Stable to 160
24	42090:1	Triphenylmethane (Barium salt of Acid dye)	Bright Greenish Blue	V. good	Good	—	Severe bleeding	—	Good	Insol	Poor	— / Fair (darkens slightly)
25	21180	Disazo (Pigment)	Reddish Navy	Insol	—	—	Bleeds slightly	—	Bleeds slightly	Bleeds severely	Fair	— / —
26	21185	Disazo (Pigment)	Reddish Navy	Insol	—	—	Bleeds very slightly	—	Bleeds severely	Bleeds severely	Good	— / —
27	77510 77520	Inorganic	Blue	—	Insoluble in organic solvents						Excellent	— / Stable to 120 darkens above 120
28	77346	Inorganic	Blue	Insoluble in organic solvents							Excellent	— / Stable to 900–1000

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Blue
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Insol	Unalt	—	—	—	—	—	None	Primarily in rubber. Also printing inks, plastics and vinyl products, flexographic, gravure, foil inks, automotive paints, oil and water paints **Textile dyeing**: *See* C.I. Vat Blue 14	22
—	—	—	V. good	—	—	—	—	Primarily in transparent NC lacquers and stoving enamels; also in printing inks	23
V. good	Poor	Poor	Insol	V. good	—	—	Severe	Primarily in printing ink, especially for multicolour printing including tinplate printing. Also in rubber and PVC. Occasionally in lacquers. Used for production of green pigments by co-precipitation of barium salts with C.I. Acid Yellows 1 or 3 **Literature** Hester and Allen, *Ind. Eng. Chem.*, **45** (1953), 1610 The parent dye is C.I. Acid Blue 9	24
Insol	Unalt	Unalt	—	Bleeds slightly	—	—	—	In rubber, linoleum and textile printing; occasionally in plastics, printing inks and emulsion paints	25
Insol	Unalt	Unalt	—	Bleeds slightly	—	—	—	In alkyd resin enamels and lacquers; occasionally in printing inks, rubber and plastics and in textile printing	26
Insol	Poor (becomes dirty green to brown)	Unalt	Insol	Insol	—	—	None (but becomes brown)	**Prussian Blue.** Great variety of uses because of its good hue, high tinctorial value, relatively low cost and good fastness to most agencies; unsuitable for use in alkaline media. Principal uses in printing inks, paints and alkyd resin enamels (both as blue and admixture with yellows for greens, *see* C.I. Pigment Green 15), paper coating and staining. Also linoleum and leathercloth, carbon papers and typewriter ribbons and NC lacquers. Some use in rubber, plastics and artists' colours 'Bronze Blues' are special brands for printing inks with characteristic coppery-bronze top tone. 'Soluble Blues' are highly dispersed products for paper colouring. 'Potash Blues' provide the highest quality of Bronze Blue Because of the intense hue Prussian Blue is generally used reduced with other pigments, especially whites. In its lack of fastness to alkali it is complementary to Ultramarine (C.I. Pigment Blue 29) **Standards** BS 283:1965 Prussian Blue for paints USA National Bureau of Standards, Standard sample No. 325 USA Fed. Spec. TT–P–36.5 Iron Blue, dry Holland NEN 885:1964 (Pigments, test method for Iron Blue) Swedish S:S 1957 16 04 11 Steel Blue USSR GOST 10960:1964 Milori Blue Dry **Literature** *BIOS* 1402, 13–71 Keggin and Miles, *Nature*, **137** (1936), 577 (Structure)	27
Insol	Unalt	Unalt	—	—	—	—	—	**Cobalt Blue.** Chiefly in the ceramics industries, especially for 'Matt Blue', and in manufacture of coloured glass; also in bank note printing and in artists' colours. Some use of special brands in paints, printing inks, lacquers (especially stoving enamels), emulsion paints and distempers rubber, plastics and paper. A special use is in poster tints with white. Also for the manufacture of greens of similar high fastness **Literature** *BIOS* 1402, 174, 222 *Wagner*, 230 Gant, *Chem. & Ind.*, **44** (1925), 160	28

C.I. Pigment Blue 29—52

C.I. Pigment Blue	C.I. Constitution No.	Chemical Class	Hue	FASTNESS									
				ORGANIC SOLVENTS							Light	Heat	
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C	Stability °C
29	77007	Inorganic	Bright Violet →Bright Bluish Green	Insoluble in organic solvents							Excellent	—	Stable to 300
30	77420	Inorganic	Blue	—	—	—	—	—	—	—	—	—	—
31	77437	Inorganic	Blue	—	—	—	—	—	—	—	—	—	—
32	77365	Inorganic	Blue	Insoluble in organic solvents							Excellent	—	Stable to 900–1000
33	77112	Inorganic	Greenish Blue	—	—	—	—	—	—	—	Excellent	—	Excellent
34	77450	Inorganic	Blue	—	—	—	—	—	—	—	Unaffected	—	Unaffected
35	77368	Inorganic	Blue	Insoluble in organic solvents							Excellent	—	—
36	77343	Inorganic	Bright Reddish Blue→ Bright Greenish Blue	Insoluble in organic solvents							Excellent	—	Stable to > 660
37–51	—	—	—	These C.I. Generic Names are discontinued							—	—	
52	—	Anthraquinone (Salt of Acid dye)	Navy	Insol	—	—	Poor	—	—	(*Benzene*) Insol	Good (Linseed oil)	—	Stable to 150 No sublimation

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Blue
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Insol	Unalt	Poor (Decolorised)	V. good	Insol	—	—	None	**Ultramarine.** Paints, alkyd resin enamels, lacquers, distempers and emulsion paints; also paper colouring and coating, wallpaper; rubber, plastics, vinyl products, leathercloth, bookcloth, soap, linoleum; artists' colours. Specially finished brands are used in printing inks and cosmetics. As 'Laundry Blue' it is used as a whitening agent. Ultramarine is especially useful where fastness to lime or alkali is required but generally unsuitable in acid media although acid resistant brands are available. Thus it is in some degree complementary to Prussian Blue (**C.I. Pigment Blue 27**) **Literature**: *Thorpe*, **II**, 776	**29**
Note—In the decomposition by acids hydrogen sulphide is evolved. Different varieties are affected by atmospheric exposure in different degrees, the pale greenish varieties usually the most and the dark blue varieties the least **Standards** BS 314:1968 Ultramarine Pigments Type 1 for paints, Type 2 for plastics and rubber, Type 3 as a blueing agent USA Fed. Spec. TT–P–450 (2) Egypt EOS 1963 408 Ultramarine Blue and Violet for paints France T–31–003 Holland NEN 5270: 1964 Pigments: test methods for Ultramarine Blue India IS 55 Poland PNC 81012 USA National Bureau of Standards, Standard Sample No. 324									
—	—	Poor (soluble)	—	—	—	—	—	**Bremen Blue.** Naturally occurring copper carbonate (**Azurite**) has been used as a pigment from very early times. Some use as a filler for striking green lakes, especially for oil paints. Used in paints for sun blinds (India) where it has fly-repellant value, in tempera and in the porcelain industry (Japan) **Literature**: *BIOS* 1402, 149	**30**
—	—	—	—	—	—	—	—	**Egyptian Blue.** Used in ancient Egypt. In fresco; unsuitable in oil media. Hue varies from pale lavender to deep blue	**31**
Insol	Unalt	Unalt	Insol	Insol	—	—	None	**Azure Blue.** As a true glass has low tinting strength and is used chiefly in ceramics and glass. Has a few specialised pigment uses as coarse particles giving a sparkling effect **Literature** Gant, *Chem. & Ind.*, **44** (1925), 160	**32**
—	Unalt	Darkened	—	—	—	—	—	**Cement Blue, Manganese Blue.** For colouring Portland cement; unsuitable for Belgian cement **Literature**: *BIOS* 1402, 157	**33**
Affected by some soluble salts, especially sodium and aluminium sulphates									
Insol	Insol	Unaffected by hydrogen sulphide						**Copper Blue.** Much used in antiquity, especially in Egypt. Use now confined to linseed oil varnishes. Very low durability without the protection of varnish	**34**
Unaffected by chemical reagents								**Cerulean Blue.** Artists' colours. The hue is greener than that of **C.I. Pigment Blue 28** and is free from any violet cast **Literature**: *Wagner*, 230	**35**
Insol	Unalt	Unalt	—	—	—	None	—	Rubber, plastics of all kinds, paper. Also suitable for printing inks, lacquers and enamels	**36**
—	—	—	—	—	—	—	—	—	**37–51**
Fair	Fair (weaker)	Poor	Insol	—	—	None	Bleeds	In oil media and plastics	**52**

C.I. Pigment Blue 53—66

C.I. Pigment Blue	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
53	—	Triarylmethane (PTMA* salt of Basic dye)	Blue→ Greenish Blue	—	—	—	—	—	—	—	—	— / —
54	—	—	—	This C.I. Generic Name is discontinued Pigments listed here now appear under C.I. Pigment Blue 15:1 or 15:2							—	— / —
55	—	—	—	This C.I. Generic Name is discontinued								
56	42800	Triarylmethane	Greenish Blue	—	—	—	—	—	—	—	—	— / —
57	42795	Triarylmethane	Reddish Blue	—	—	—	—	—	—	—	—	— / —
58	—	Triphenylmethane	Reddish Blue	5	—	4	1	2	3	(*Benzene*) 5	2	— / Stable to 140 (Cellulose acetate)
59	—	Triphenylmethane	Blue	5	—	4	1	2	5	(*Benzene*) 5	—	256 / —
60	69800	Anthraquinone (Pigment)	Reddish Blue	—	4	—	5	4–5	—	4	7 $\frac{1}{25}$ strength (PVC)	— / 4–5 to 180 10 min
61	42765:1	Triphenylmethane (Pigment)	Blue	—	—	—	—	—	—	—	—	— / —
62	—	Triphenylmethane (Copper ferrocyanide complex)	Reddish Blue→Blue	—	—	—	—	—	—	—	—	— / —
63	73015	Indigoid (Aluminium salt of Acid dye)	Blue	Poor	—	—	V. good	—	—	Poor	—	— / —
64	69825	Anthraquinone (Pigment)	Reddish Blue	Good	—	Good	Good	Good	Fair	Good	Excellent (Exterior full strength) Good (Exterior tint)	— / Good to 200
65	59800	Anthraquinone	Reddish Blue	—	—	—	—	—	—	—	—	— / —
66	73000	Indigoid	Blue	—	—	—	—	—	—	—	—	— / —

*Phosphotungstomolybdic acid

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Blue
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticiers	PVC migration	Soap gel bleeding		
—	—	—	—	—	—	—	—	Paper coating and beater dyeing; has high tinctorial strength. Hue greener in artificial light	53
									54
									55
—	—	—	—	—	—	—	—	Printing inks; especially for toning up blacks. Has high tinctorial strength	56
—	—	—	—	—	—	—	—	Printing inks; especially for toning up blacks. Has high tinctorial strength	57
5	(*NaOH*) 5	(H_2SO_4) 5	—	5	—	—	1	Offset printing inks	58
5	(*NaOH*) 5	(H_2SO_4) 5	—	5	—	—	1	Printing inks **Constitution.** Monosulphonic acid of incompletely phenylated Pararosaniline	59
—	—	—	—	—	4	5	—	Paints, primarily for high quality applications, plastics (PVC, polyethylene, ABS polymers, acrylics) and printing inks **Textile dyeing**: *See* C.I. Vat Blue 4	60
—	—	—	—	—	—	—	—	**Constitution**: free acid of C.I. 42765 (C.I. Acid Blue 119)	61
—	—	—	—	—	—	—	—	Printing inks	62
V. good	V. good	V. good	Poor	—	—	—	—	Cosmetics The parent dye is C.I. Acid Blue 74	63
Insol	Good	—	Good	Good	—	—	Slight	**Textile dyeing**: *See* C.I. Vat Blue 6	64
—	—	—	—	—	—	—	—	**Textile dyeing**: *See* C.I. Vat Blue 20	65
—	—	—	—	—	—	—	—	**Textile dyeing**: *See* C.I. Vat Blue 1	66

C.I. Pigment Green 1—7

C.I. Pigment Green	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
1	42040:1	Triphenylmethane (PTMA* salt of Basic dye)	Bright Bluish Green	5	1	4–5	1	1	1	4–5	4 (Full strength) 3–4 ($\frac{1}{25}$ strength)	— / 3–4 to 150 (30 min)
2	42040:1 and 49005:1	Triphenylmethane and Thiazole (PTMA salts of Basic dyes)	Bright Green	4–5	1	4	1	1	1	4	4 (Full strength) 3–4 ($\frac{1}{25}$ strength)	— / 3–4 to 150 (30 min)
3	41000:2 and 42040:1	Ketone imine and Triphenylmethane (PTMA salts of Basic dyes)	Bright Green	As for C.I. Pigment Green 2							Good	— / Good
4	42000:2	Triphenylmethane	Bright Green	V. good	—	—	Poor	—	Poor	V. good	Good	— / Good
5				This C.I. Generic Name is discontinued Pigments formerly listed under it now appear under C.I. Pigment Green 1								
6	—	Inorganic and salt of Basic dye	Olive	—	V. good	—	Insol	—	Insol	Insol	Good	— / Excellent
7	74260	Phthalocyanine	Bright Green	5	4–5	5	4–5	4–5	5	5	7–8 ($\frac{1}{3}$ strength)	— / 5 to 150 (20 min)

*Phosphotungstomolybdic acid. Some brands are PTA (phosphotungstic acid) or PMA (phosphomolybdic acid) salts

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Green
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
4–5	5	5	5	5	5	—	5	Primarily for printing inks giving bright hue, high tinctorial strength, clean tone and transparency. Some use in paints, alkyd resin enamels and emulsion paints. Wrapper and tinplate printing, paper coating, wallpaper, bookcloth, textile printing, typewriter ribbons and copying papers, leather finishes, plastics, rubber (cold cure) and artists' materials The parent dye is C.I. Basic Green 1 *Discoverers*—C. Immerheiser and B. Zschimmer 1925; P. Rabe 1926 **Literature** I.G., *BP* 265032, *FP* 608301, *GP* 449539 (*Fr.* **15,** 1815); *BP* 292253, 294286; *USP* 1736835, *GP* 503811 (*Fr.* **17,**1506) *BIOS* 961, 27; *BIOS* 1661, 16, 30 *FIAT* 764—Fanalgruen G. Supra Plv.	**1**
3–4	4	5	4–5	4	2–4	—	1	Usage closely similar to that of C.I. Pigment Green 1 **Literature** **Patents**—as for **C.I. Pigment Green 1** *BIOS* 961, 29 *BIOS* 1661, 16, 43 *FIAT* 764—Fanalgelbgruen G Supra Plv. The parent dyes are C.I. Basic Green 1 and C.I. Basic Yellow 1 (or C.I.48060)	**2**
As for C.I. Pigment Green 2								Usage as for C.I. Pigment Green 1 The parent dyes are C.I. Basic Yellow 2 and C.I. Basic Green 1 in typical proportions of 80/20 **Literature** Patents as for **C.I. Pigment Green 1** *BIOS* 961, 28 *FIAT* 764—Fanalgelbgruen GG Plv.	**3**
Good	V. good	V. good	—	—	—	—	Severe	Primarily printing inks. Occasionally paints (not external), alkyd resin enamels, emulsion paints, textile printing, paper, plastics The parent dye is C.I. Basic Green 4	**4**
									5
Insol	Unalt	Unalt	Insol	Insol	—	—	Bleeds	Printing inks, lacquers and emulsion paints and distempers	**6**
5	5	5	5	5	5	—	5	Paints, printing inks, lacquers, emulsion paints and distempers, linoleum, leathercloth, bookcloth, paper surfacing and wallpaper, inks for tin printing. Also plastic masses and rubber and artists' materials **Literature** Haddock, *JSDC*, **61** (1945), 68 Brouillard, *Am. Ink Maker*, **32** (1954), (i) 32, (ii) 30, 65	**7**

Standard
BS 3599/6–15:1964 Polychlorocopperphthalocyanine

C.I. Pigment Green 8—15

C.I. Pigment Green	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
8	10006	Nitroso (Iron complex of Acid dye)	Yellowish Green→ Olive	4–5	3–4	3–4	3–4	2–3	3–4	4–5	5–6 (½ strength)	— / 4–5 to 150 (20 min)
9	49415	Indamine (Barium salt of Iron complex)	Bright Green	Insol	—	—	Insol	—	—	Insol	V. good	— / Stable to 120
10	12775	Monoazo (Nickel complex)	Yellowish Green	Insol	—	—	Bleeds severely	—	Bleeds severely	Insol	Excellent	— / Good
11	—	Organic (Pigment)	—	—	Insol	—	Insol	—	Insol	Insol	Excellent	— / Stable to 150
12	10020:1	Nitroso (Barium salt of Iron complex)	Dull Green	—	V. good	—	Insol	—	Insol	Insol	Good	— / Stable to 150
13	74200 and 77603	Phthalocyanine (Barium salt) and Inorganic	Yellowish Green→ Green	5	4–5	5	4–5	5	4–5	5	6–7 (Full strength) 5 (⅓ strength)	— / 4 to 150 (20 min)
14	77199 and 77346	Inorganic	Green	Insoluble in organic solvents							Excellent	— / Excellent
15	77520 and 77600, 77601 or 77603	Inorganic	Yellowish Green→ Olive	Insoluble in organic solvents							Excellent	— / Stable to 175

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Green
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
5	5	5	4–5	4–5	1–3	—	5	Emulsion paints and distempers, wallpaper and paper coating on account of the high fastness to lime and alkalis. Also paints, alkyd resin enamels and printing inks (including wallpaper and foil); rubber, PVC, P/F, U/F and amino plastics, leathercloth, bookcloth, linoleum; cement. Textile printing and mass pigmentation of cellulose acetate	**8**
V.good	V.good (bleeds slightly)	V.good (bleeds slightly)	Insol	Insol	—	—	—	Paints, printing inks, distempers and, particularly in admixture with C.I. Pigment Yellow 1 or 3, in wallpaper **Literature** M.L.B., *GP* 224442 (*Fr.* **10**, 279)	**9**
Insol	Good	V.good	Insol	Insol	—	—	Slight	Alkyd resin enamels and lacquers; occasionally in printing inks and plastics	**10**
Standard BS 3599/6–15:1964 Nickel Azo Yellow									
Insol	Unalt	Unalt	Insol	Insol	—	—	None	Paints, printing inks, lacquers, emulsion paints and distempers, rubber, PVC and aminoplastics	**11**
V.good	Good	Poor	Insol	Insol	—	—	Bleeds	Printing inks and lacquers **Literature** *BIOS* 961, 109—Appendix 7	**12**
4–5	(*NaOH*) 1	2	5	4	5	—	2–3	Paints, printing inks, enamels, cellulose and synthetic finishes, emulsion paints, and distempers; also linoleum, paper surfacing, wallpaper printing and leathercloth. Textile printing **Constitution**: Product of co-precipitation of C.I. Pigment Blue 17 and C.I. Pigment Yellow 34	**13**
Insol	Unalt	V.good	Insol	Insol	—	—	None	**Cadmium Green.** Paints, printing inks (especially poster inks with white), stoving lacquers, emulsion paints and distempers; rubber, plastics and paper **Constitution**: Mixed pigments of C.I. Pigment Yellow 37 with blue pigments, especially C.I. Pigment Blue 28	**14**
Insol	Poor (yellower)	Poor	Insol	Insol	—	—	None, but becomes slightly yellower	**Brunswick Green.** Large use in paints, alkyd resin enamels and lacquers on account of its good opacity, tinctorial power, durability and relatively low cost; occasional use in printing inks. Also leather finishes, linoleum, leathercloth, plastics, paper coating and staining **Constitution**: Mixed pigments obtained by forming C.I. Pigment Yellow 34 on a substrate of C.I. Pigment Blue 27 or by dry or wet mixing of the yellow and blue components	**15**
Standards BS 303:1965 Brunswick or Chrome Greens (Pure and Reduced) for paints BS 381C:1953 Colours for ready mixed paints BS 2660:1955 USA National Bureau of Standards, Standard Samples Nos.326–328 Holland NEN 1533:1964 (Pigments: test methods for Chrome Greens)									

C.I. Pigment Green 16—22

C.I. Pigment Green	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
16	77955 and 77525 or 77007	Inorganic	Yellowish Green→ Green	Insoluble in organic solvents							Excellent	— / Stable to 95
17	77288	Inorganic	Yellowish Green→ Green	Insoluble in organic solvents							Excellent	— / Stable to 900–1000
17:1	77298	Inorganic	Yellowish Green→ Green	Insoluble in organic solvents							—	— / —
18	77289	Inorganic	Green→ Bluish Green	Insoluble in organic solvents							Excellent	— / Stable to 250 then blackens
19	77335	Inorganic	Dull Yellowish Green	Insoluble in organic solvents							Excellent	— / Excellent
19:1	77343	Inorganic	—	Insoluble in organic solvents							—	— / —
20	77408	Inorganic	Green	—	—	—	—	—	—		Fair	— / —
21	77410	Inorganic	Bright Green	—	—	—	—	—	—	—	Good	— / Poor
22	77412	Inorganic	—	Very similar to C.I. Pigment Green 21							—	— / —

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Green
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Poor	Poor	Poor	Insol	Insol	—	—	Bleeds	**Zinc Green.** Primarily paints, enamels and artists' colours. Compared with C.I. Pigment Green 15 is brighter in hue, unaffected by hydrogen sulphide, less susceptible to floating and free from toxic hazards of lead pigments but has less hiding power and is less fast to weathering **Constitution**: Mixed pigments of C.I. Pigment Yellow 36 with the blue pigments, especially C.I. Pigment Blues 15, 17, 29	16
	Standards BS 303:1938 Holland NEN 1964 1941 (Pigments: test methods for Zinc Green)								
Insol	Unalt	Unalt	Insol	Insol	—	—	None	**Chromium Oxide Green.** Paints, printing inks, lacquers and stoving finishes, emulsion paints and distempers; ceramic glazes; cement; rubber and plastics; paper **Literature** *BIOS* 1402, 137 *FIAT* 814	17
	Standards BS 318:1952 BS 1014:1952 (for cement, magnesium oxychloride and concrete) Argentine IRAM 1961:1183 Green Chromic Oxide for paints								
—	—	—	—	—	—	—	—	**Arnaudon's Green.** Similar in properties and usage to C.I. Pigment Green 17. Also as primer for iron, steel and light metals.	17:1
Insol	Unalt	Unalt	Insol	Insol	—	—	None	**Chrome Oxide (Hydrated) Green.** High grade paints, enamels, lacquers, stoving finishes and printing inks; ceramic painting and glass; artists' colours, rubber, plastics and paper. Hue much brighter than C.I. Pigment Green 17. Used with C.I. Pigment Yellow 36 for yellowish greens **Literature** *BIOS* 1402, 144. *FIAT* 814, 61	18
	Standards BS 1014:1952 (for cement, magnesium oxychloride and concrete) Argentine IRAM 1961 1183 Hydrated Green Chromium Oxide for paints Holland NEN 1965 5276 Pigments: test methods for Chrome Oxide Green								
Insol	Unalt	Unalt	—	—	—	—	—	**Cobalt Green.** Artists' colour	19
—	—	—	—	—	—	—	—	**Turquoise Green.** Porcelain painting Related in constitution to C.I. Pigment Green 19.	19:1
Partially soluble	Unalt (Soluble in ammonia)	Soluble	—	—	—	—	—	**Verdigris.** Toxic and used primarily in anti-fouling paints	20
—	(*Alkalis*) Soluble: decomposed hot	Soluble	Good	—	—	—	—	**Paris Green.** Discovered by Russ and Sattler at Schweinfurt in 1814 and at one time used in calico printing. No longer used generally as a pigment because of its high toxicity. Used in anti-fouling compositions and as an insecticide (mosquito larvicide). Blackened by hydrogen sulphide	21
	Very similar to C.I. Pigment Green 21							**Scheele's Green.** Usage very similar to that of C.I. Pigment Green 21. Used in calico printing *ca.*1840, fixed with albumen **Standard**: India IS 53	22

C.I. Pigment Green	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
23	77009	Inorganic	Greenish Grey→Olive	Insoluble in organic solvents							Excellent	— / Becomes brownish red
24	77013	Inorganic	Green	Insoluble in organic solvents							Excellent	— / Poor
25	74200 and 77788	Phthalocyanine (Barium salt) and Inorganic	Bright Green	Insol	—	—	Insol	—	—	—	Excellent PVC or varnish	— / Stable to 300
26	77343	Inorganic	Dull Bluish Green	Insoluble in organic solvents							Excellent	— / Stable to >600
27–35	—	—	—	These C.I. Generic Names are discontinued								
36	*74160* Chloro and brominated derivatives	Phthalocyanine	Green→ Yellowish Green	5	5	5	5	5	4–5	5	7 (50:50 reduction) 6–7 ($\frac{1}{25}$ strength)	— / 5 150 (20 min) or 180 (10 min)
37	74255	Phthalocyanine	Bluish Green	—	—	—	—	—	—	—	Excellent	— / —
38				This C.I. Generic Name is discontinued. All information is transferred to C.I. Pigment Green 36								
39				This C.I. Generic Name is discontinued. All information is transferred to C.I. Pigment Green 1								
40				This C.I. Generic Name is discontinued								
41				This C.I. Generic Name is discontinued. All information is transferred to C.I. Pigment Green 36								
42				This C.I. Generic Name is discontinued. All information is transferred to C.I. Pigment Green 7								
43				This C.I. Generic Name is discontinued. All information is transferred to C.I. Pigment Green 36								
44				This C.I. Generic Name is discontinued. All information is transferred to C.I. Pigment Green 7								

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Green
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Insol	(*Alkalies*) Unalt	Partially soluble	—	—	—	—	—	**Green Earth.** Usage chiefly as a substrate for Basic dyes, especially C.I. Basic Green 1 for the manufacture of **Lime Green** for use in lime, sodium silicate or size media. Used as an artists' oil and watercolour from Roman times but lacks body and intensity and is now little used as such	23
—	(*Alkalies*) Unalt	Decomposed (Hydrogen sulphide evolved)	—	—	—	—	—	**Green Ultramarine.** Lime colour, particularly exterior work, in size media and for wallpaper but now relatively little used on account of relative cost	24
Insol	Unalt	Unalt	—	—	—	—	—	Oil and emulsion paints, cellulose ester and synthetic resins, printing inks and mass coloration of plastics	25
Insol	Unalt	Unalt	—	—	—	None	—	Coloration of rubber, paper and plastics of all kinds. Suitable for printing inks, lacquers and enamels	26
									27–35
5	5	5	5	5	5	—	5	Suitable for use in almost all media. Widely used in all types of paints and printing inks. Also in vinyl compounds, linoleums, rubber, lacquers, leather finishes, textile printing, mass pigmentation of viscose	36
Insol	—	—	Insol	—	—	—	—	In paints and printing inks	37
									38
									39
									40
									41
									42
									43
									44

Note—**C.I. Pigment Green 36** covers the poly(bromochloro) derivatives of copper phthalocyanine (C.I. 74160), the hues of which vary in degree of yellowness with the total amount of halogenation and with the proportion of bromo- to chloro-substitution while the other physical properties and the chemical and application properties remain practically the same throughout the whole series of compounds. Moreover, information supplied by manufacturers shows that the same hue can sometimes be obtained from different total halogenation/bromo-substitution/chloro-substitution ratios.

C.I. Pigment Greens 38, 41 and **43** which covered different poly(bromochloro)phthalocyanines have therefore been discontinued and all information has been placed under **C.I. Pigment Green 36**

C.I. Pigment Green 45—48

C.I. Pigment Green	C.I. Constitution No.	Chemical Class	Hue	FASTNESS									
				ORGANIC SOLVENTS							Light	Heat	
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C	Stability °C
45	—	Triphenylmethane + Thiazine (Copper ferrocyanide complex)	Green	—	—	—	—	—	—	—	—	—	—
46	—	Disazo	Olive	5	—	4–5	4–5	4–5	—	4–5	7	—	—
47	59825	Anthraquinone	Bluish Green	—	—	—	—	—	—	—	—	—	—
48	77600 or 77603 and 74160 or 74260	Inorganic + Phthalocyanine	Green	Insoluble in organic solvents							Excellent	—	Stable to 200

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Green
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
—	—	—	—	—	—	—	—	In printing inks	45
5	5	5	—	—	4–5	—	—	Coloration of PVC	46
—	—	—	—	—	—	—	—	**Textile dyeing**: *See* C.I. Vat Green 1	47
Insol	Poor	Poor	Insol	Insol	—	—	Bleeds	For paints and plastics **Constitution**: Mixed pigment corresponding to C.I. Pigment Yellow 34 and C.I. Pigment Blue 15 (or in some brands +C.I. Pigment Green 7)	48

C.I. Pigment Brown 1—6

C.I. Pigment Brown	C.I. Constitution No.	Chemical Class	Hue	FASTNESS									
				ORGANIC SOLVENTS							Light	Heat	
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C	Stability °C
1	12480	Monoazo (Pigment)	Reddish Brown	—	—	—	Poor	—	Poor	Poor	Excellent	—	Stable to 140
2	12071	Monoazo Copper complex (Pigment)	Reddish Brown	—	Poor	—	Poor	—	Poor	Poor	V. good	—	Poor (blackens)
3	21010	Disazo (PTMA* salt of Basic dye)	Brown	—	Poor	—	Poor	—	V. good	V. good	V. good	—	Good (very slight darkening at 150)
4	—	PTMA* salt of Basic dye	Brown	—	Poor	—	Poor	—	Poor	Poor	V. good	—	Stable to 150 (marked colour change above)
5	15800:2	Monoazo Copper salt	Brown	Insol	—	—	Poor	—	Poor	Good	V. good	—	—
6	77491 77492 77499	Inorganic	Brown→ Reddish Brown→ Dull Red	Insoluble in organic solvents							Excellent	—	Stable to 150

*PTMA = Phosphotungstomolybdic acid

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Brown
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Insol	Unalt	Unalt	V.good	Poor	—	—	None	Primarily for printing inks, including inks for rubber stamp printing on Cellophane, and in mass pigmentation of viscose	1
V.good (Bleeds slightly)	Unalt	Unalt	Poor	Poor	—	—	Slight	Paints and printing inks; occasionally emulsion paints and wallpapers **Constitution**: Copper complex of C.I. Pigment Red 1	2
Insol	Poor (Bleached)	Unalt	Insol	Poor	—	—	Bleeds	Primarily printing inks; also paper coating and artists' materials The parent dye is C.I. Basic Brown 4	3
Insol	Good (slight discoloration)	Good (slight discoloration)	V.good	V.good	—	—	Bleeds	Primarily printing inks including inks for tinplate and wallpaper printing; also paper dyeing and coating	4
Insol	V.good	Decomposed (Removes metal)	—	Poor	—	—	—	Lacquers, enamels and printing inks The corresponding Barium salt is C.I. Pigment Red 64	5
Insol	Unalt (*NaOH*) Unalt	Dissolved	—	—	—	—	—	**Brown Iron Oxides, Brown Magnetic Oxide.** Manufactured products. Widely used as an inexpensive pigment in industrial paints and enamels and generally in paints, alkyd resin enamels, lacquers, emulsion paints, printing inks. Also in stoving finishes, paper, rubber and plastics including vinyl products; linoleum; textile printing; and in cement and concrete **C.I. Pigment Browns 6** and **7, C.I. Pigment Reds 101** and **102** and **C.I. Pigment Black 11** together provide a range of hues from reddish orange through dull red and bordeaux to brown and black in pigments of similar chemical constitution, fastness properties and usage **Literature** *FIAT* 814, 57 Iron oxide for magnetic systems, also for polishing rouge Storey, *J. Oil Col. Chem. Ass.*, **15** (1932), 33 Smith, *ibid*, **20** (1937), 307	6

Standards
Manufactured Iron Oxides
BS 305 and 851:1952; BS 2876:1957 (Indian Red (Synthetic), Mars Red)
USA Fed. Spec. TT–P–381; TT–P–375
Australia K 60
India IS 45
Red Oxide of Iron
BS 370:1952
Poland PN C 81020
S. Africa SABS 293
Yellow Oxide of Iron
Sweden SIS 16 04 08
Black Oxide of Iron
Sweden SIS 16 04 09
Venetian Red
BS 370:1952; BS 2876:1957 (Venetian Red defined as chemically prepared ferric oxide with a proportion of calcium sulphate)
USA Fed. Spec. TT–Y–226 (1)
Blended Red Oxides of Iron
BS 694:1936
Red and Yellow Oxide of Iron Pigment for Cement
BS 1014:1942
Iron Oxide Pigments
USA ASA K 25
Argentine IRAM 1015
France T 31–002
Holland N 882 and 883

C.I. Pigment Brown 7—24

C.I. Pigment Brown	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
7	77491 77492 77499	Inorganic	Brown→ Reddish Brown→ Dull Red	Insoluble in organic solvents							Excellent	— / Stable to 150
8	77727 77730	Inorganic	—	Insoluble in organic solvents							Excellent	— / —
9	77430	Inorganic	Reddish Brown→ Brownish Violet	Insoluble in organic solvents							V. good	— / Good
10	77227	Inorganic	—	—	—	—	—	—	—	—	—	— / —
11	77495	Inorganic	—	Insoluble in organic solvents							Excellent	— / Excellent
12–21	—	—	—	These C.I. Generic Names are discontinued								
22	—	Nitro	Reddish Brown	—	—	—	—	—	—	—	—	— / —
23	—	Disazo	Dull Reddish Brown	Insol	V. good	—	Insol	—	V. good	V. good	Excellent	— / —
24	77310	Inorganic	Yellowish Brown	—	—	—	—	—	—	—	—	— / —

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Brown
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
As for C.I. Pigment Brown 6								Natural forms of **C.I. Pigment Brown 6** Properties and usage closely similar to those of C.I. Pigment Brown 6	7
				Standards *Natural Iron Oxides* BS 272:1952; BS 2876:1957 (Indian Red) *Ochre* BS 337:1952; BS 2876:1957 (Light Red) USA ASTM D85–47 Australia K 65 India IS 47 Poland PN C 608 *Yellow Ochre* BS 337:1952; BS 2876:1957 (Golden ochre, Yellow ochre) USA Fed. Spec. TT–P–450A, TT–P–395 France T 31–002 India IS 47				*Raw Sienna* BS 312:1952; BS 2876:1957 USA ASTM D765–48 *Sienna* BS 312:1952; BS 2876:1957 (Burnt Sienna) USA ASTM D765–48 Australia K 63 India IS 48 *Natural Umber* BS 312:1952; BS 2876:1957 (Natural Umber) USA ASTM D763–48 India IS 49 *Burnt Umber* BS 313:1952; BS 2876:1957 USA ASTM D763–48 Australia K 64 India IS 49 Poland PN C 623	
Insol	Unalt	Soluble (Chlorine evolved)	—	—	—	—	—	**Manganese Brown.** Used in cheap size colours and oil colours but has very strong drying properties. Because of fastness to lime used in lime and cement colours and in artificial stone. Formerly used in calico printing	8
Insol	Slight bleeding	No bleeding	—	—	—	—	Slight	**Copper Ferrocyanide.** Paints, alkyd resin enamels and lacquers and occasionally for emulsion paints, printing inks, paper, plastics, vinyl products and textile printing	9
Slowly hydrolysed	—	—	—	—	—	—	—	**Calcium Plumbate.** Used in oil bound paints employed as undercoats in protective painting of steel structures, particularly structures liable to prolonged water immersion **Literature** Read, *J. Oil. Col. Chem. Ass.*, **33** (1950), 295	10
				Standard BS 3699: 1964 (Calcium plumbate for paint)					
Insol	Unalt	Soluble	Insol	—	—	—	None	**Magnesium Ferrite.** Paints, alkyd resin enamels, lacquers, textile printing, rubber, paper, plastics, vinyl products, cement and cement asbestos products. Occasionally in emulsion paints and printing inks	11
									12–21
—	—	—	—	—	—	—	—		22
Insol	Insol	Insol	Insol	V. good	—	—	None	Oil paints, printing inks, cellulose ester and resin lacquers, PVC, polyesters	23
									24

C.I. Pigment Brown 25—29

C.I. Pigment Brown	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
25	—	Monoazo	Reddish Brown	4–5	—	4	4	3–4	—	(*Toluene*) 4	7–8	— / —
26	71129	Perylene	Reddish Brown	—	—	—	—	—	—	—	—	— / —
27	73410	Indigoid	Brown	—	—	—	Insol	—	—	V.good	—	— / —
28	69015	Anthra-quinone	Brown	Fair	—	—	Fair	Poor	Fair	Poor	Excellent (Full and tint strengths)	— / Good to 280
29	77500	Inorganic	Brown	Insoluble in organic solvents							Excellent	— / Excellent

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Brown
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
5	—	—	—	—	4–5	—	—	PVC	25
—	—	—	—	—	—	—	—		26
—	—	—	—	—	—	—	—	Paints and printing inks	27
								Textile dyeing: *See* C.I. Vat Brown 5	
Insol	(*NaOH*) Good	Good	—	—	—	—	Good	Textile printing, viscose spin dyeing, transparent baking enamels, polystyrene, polypropylene, polyurethane foam **Textile dyeing**: *See* C.I. Vat Brown 3	28
Insol	Insol (*NaOH*) Insol	Insol	Insol	Insol	—	—	None	Mainly for paints and plastics, including reduced tones, where high light fastness and weathering resistance required	29

C.I. Pigment Black 1—7

C.I. Pigment Black	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
1	50440	Azine (Pigment)	Black	4–5	4	4–5	4	3–4	3–4	3–4	7–8 (Full strength) 6 (½ strength)	— 3 150 20 min
2	—	Organic (PTMA* salt of mixed Basic dyes)	Black	—	Poor	—	Poor	—	Poor	Poor	V. good	— Stable to 150 Marked colour change > 150
3	—	Organic (PTMA* salt of mixed Basic dyes)	Black	—	Poor	—	Poor	—	V. good	Insol	V. good	— Stable to 150
4	—	Organic (PTMA* salt of mixed Basic dyes)	Black	—	Poor	—	Poor	—	Poor	Insol	V. good	— Stable to 150
5	—	Organic (Complex salt of Mordant dye)	Black	—	Insol	—	Insol	—	Insol	Insol	V. good	— Stable to 120 (not recommended above)
6	77266	Inorganic	Black	Insoluble in organic solvents							Excellent	— Excellent
7	77266	Inorganic	Black	As C.I. Pigment Black 6							As C.I. Pigment Black 6	

*Phosphotungstomolybdic acid

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Black
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
4	4–5	4–5	5	5	4–5	—	Slight	**Aniline Black.** Shows a low reflectance in full shades and a low electrical conductivity. Used for lacquers, emulsion paints and distempers; leather cloth, linoleum, vinyl, U/F, P/F, and styrene resins and plastics. Paper staining, carbon papers and typewriter ribbons. Limited use for printing inks including tin plate, wallpaper and wrapper printing **Constitution**: oxidation product of C.I. Oxidation Base 1	1
Insol	Good (slight discoloration)	Good (Slight discoloration)	V. good	V. good	—	—	Bleeds	Printing inks	2
Insol	Unalt	Unalt	V. good	Poor	—	—	Bleeds	Printing inks	3
Insol	V. good	V. good	Insol	Insol	—	—	Bleeds	Printing inks	4
Insol	Unalt	Unalt	Insol	Insol	—	—	None	Paints, printing inks and lacquers, particularly where high resistance to solvents is required	5
Insol	Unalt	Unalt	Insol	Insol	—	—	None	**C.I. Pigment Blacks 6–10** consist essentially of elementary **Carbon.** With the exception of **C.I. Pigment Black 10** which covers graphite, a naturally occurring crystalline carbon, all are produced by combustion of carbonaceous material. Physical properties and the nature and quantity of impurities vary with the nature of the combustible material and determine the pigmentary properties **C.I. Pigment Black 6** 'Lamp Black' and **C.I. Pigment Black 7** 'Carbon Black' are almost pure carbon. They are used in paints, printing inks, especially newsprint, enamels, lacquers, plastics, carbon papers and typewriter ribbons. Very large quantities are used in rubber manufacture where its function is mechanical and only incidentally pigmentary. **Vegetable Black** (Black 6) is greyish in tints and somewhat less intense than **Carbon Black** which is brownish in tints. Vegetable Black tends to be greasy and unsuitable in water paints; it also tends to retard the drying of oil paints. **Acetylene Black** (Black 7) is inferior to **Gas Black** (Black 7) in colour and strength	6 7
			As C.I. Pigment Black 6						

Standards
BS 284:1952 Carbon Black for Paints
BS 286:1952 (incorporated with BS 284) Lamp (or Vegetable) Black for paints
BS 1014:1942 Carbonaceous black pigments for cement, magnesium oxychloride and concrete
USA National Bureau of Standards, Standard samples Nos. 311, 312, 318
USA ASA K 26–1 (Lamp Black); ASTM D84–41; Fed. Spec. TT–L–70 (1)
USA Fed. Spec. TT–C–120 (1) (Carbon Black)
Argentine IRAM 1021 (Lamp Black) and 1057 (Carbon Black)
India IS 40, 42 and 43
Poland PN C 616
Testing
Holland NEN 1531:1963 Pigments: Method of test for Carbon Black

Literature
Brown and Smith, *Ind. Eng. Chem.*, **34** (1942), 352
Venuto, *American Ink Maker*, **25** (1947), 29
Thorpe, IX, 639

C.I. Pigment Black 8—15

C.I. Pigment Black	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
8	77268	Inorganic	Black	Insoluble in organic solvents							Excellent	— / Excellent
9	77267	Inorganic	Black	Insoluble in organic solvents							Excellent	— / V. good (leaves white ash, chiefly calcium phosphate, when strongly ignited)
10	77265	Inorganic	Greyish Black with metallic lustre	Insoluble in organic solvents							Excellent	— / Excellent
11	77499	Inorganic	Bluish Grey →Black	Insoluble in organic solvents							Excellent	— / Stable to 150
12	77543	Inorganic		Insoluble in organic solvents							Excellent	— / —
13	77322	Inorganic	Greyish Black	Insoluble in organic solvents							Excellent	2860 (Decomposes) / Excellent
14	77728	Inorganic		Insoluble in organic solvents							—	— / Decomposes at 535
15	77403	Inorganic		Insoluble in organic solvents							Excellent	1064 / —

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Black
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Insol	Unalt	Unalt	Insol	Insol	—	—	—	**Charcoal Black** etc. In various media but now very little in paints. Much used as an absorbent of noxious gases and other impurities and hence in the purification of chemical compounds **Standards** BS 288:1937 (Mineral Black); 1014:1942 Carbonaceous black pigments for cement, magnesium oxychloride and concrete	8
Insol	Unalt	Unalt (cold) Decomposed (boiling)	Good	Insol	—	—	—	**Bone Black** etc. For deep black shades in linseed oil but tinctorial strength low and tints are brownish. Used in paints, enamels, blackings and polishes; cellulose finishes, leather cloth; cement, paper surfacing and artists' colours. Also in sugar refining **Literature** *Thorpe*, **IX**, 640	9
		Standards BS 285:1952 Bone Black for Paints USA ASA K 36.1; ASTM D20–47; Fed. Spec. TT–E–60 India IS 41 Poland PN C81011							
Insol (water repellant)	Unalt	Unalt	Insol	Insol	—	—	—	**Graphite.** Some use in stoving blacks and in technical paints for metals and anti-corrosion paints with other pigments Has great spreading power. Used in lead pencils and stove polishes. Has many non-pigmentary uses because of its heat resistance and electrical properties	10
Insol	Unalt	Soluble	Insol	Insol	—	—	None	**Iron Oxide Black.** Widely used as an inexpensive pigment in industrial paints and enamels and generally in paints, alkyd resin enamels, lacquers, emulsion paints, printing inks. Micaceous iron oxide used in protective paints, especially together with C.I. Pigment Yellow 31 or **C.I.** Pigment Red 105. Also used in stoving finishes, in paper, rubber and plastics including vinyl products; in linoleum, in textile printing and in cement and concrete **C.I. Pigment Black 11, C.I. Pigment Reds 101** and **102** and **C.I. Pigment Browns 6** and **7** together provide a range of hues from reddish orange through dull red and bordeaux to brown and black in pigments of similar chemical constitution, fastness properties and usage	11
		Standards BS 1014:1942 Black and Brown oxides of iron pigments for cement, magnesium oxychloride and concrete BS 306:1952 Black oxide of iron for paints USA National Bureau of Standards, Standard Sample No. 313 USA Fed. Spec. TT–P–390 (1) (Synthetic black iron oxide) Fed. Spec. TT–P–395 (Synthetic brown iron oxide) Australia K 61 India IS 44 Holland NEN 5268:1964 (Pigments: method of test for Black Iron oxide)							
	Fastness properties as for C.I. Pigment Black 11							**Ilmenite Black.** Titanium paints and enamels. Otherwise usage similar to that of C.I. Pigment Black 11	12
Insol	Unalt	Soluble in acids	—	—	—	—	—	**Cobalt Black.** Pigment in ceramics; too expensive for general use in paints	13
Insol	—	Dissolves	—	—	—	—	—	**Manganese Black.** As a drier in oil paints and to some limited extent as a pigment for cement and clay bricks **Literature** Storey, *J. Oil Col. Chem. Ass.*, **15** (1932), 33	14
Insol	—	Soluble	—	—	—	—	—	**Cupric Oxide.** In glass, ceramics and stoneware for green or blue shade	15

C.I. Pigment Black 16—22

C.I. Pigment Black	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
16	77945	Inorganic	Bluish Grey	Insoluble in organic solvents							—	— / —
17	77975	Inorganic	Grey	Insoluble in organic solvents							—	— / —
18	77011	Inorganic	Grey→Black	Insoluble in organic solvents							—	— / —
19	77017	Inorganic	Grey	Insoluble in organic solvents							Unalt	— / On heating loses water, nitrogen and sulphur
20	—	—	—	Insol	—	—	Insol	—	V. good	Fair	Excellent (paint)	— / Good (Stoving lacquer)
21	—	—	—	Insol	—	—	Poor	—	Fair	V. good	V. good (paint)	— / Good (Stoving lacquer
22	77429	Inorganic	Black	Insoluble in organic solvents							Unalt	— / Stable to > 1000

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment Black
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
—	—	—	—	—	—	—	—	**Zinc Dust.** In anti-corrosive paints for iron and steel and, especially in admixture with C.I. Pigment White 4 (Zinc oxide), for galvanised iron **Literature** Evans and Mayne, *Chem. & Ind.*, (1944) 109 Pass, *J. Oil. Col. Chem. Ass.*, **35** (1952), 247 Blowes, Meason and Pass, *ibid.*, **37** (1954) 483 **Standards** BS 3982 Zinc dust pigments USA Fed. Spec. TT–Z–291 (2) (Zinc dust) ASTM D520–21	**16**
—	—	—	—	—	—	—	—	**Zinc Blende.** Similar to that of C.I. Pigment White 7 (**Zinc White**). Only used when a less expensive pigment is required and the impurities present and grey hue can be tolerated **Zinc Blende** differs from C.I. Pigment White 7 in being insoluble in acetic acid: it is soluble in mineral acids	**17**
Insol	Unalt	Partially dissolved; carbon separated	—	—	—	—	—	**Slate Black.** Oil, size and lime coatings, mainly in admixture with other colours. Also in paper and in artificial stone and cement	**18**
Insol	Unalt	Partially dissolved	—	—	—	—	—	**Slate Grey.** Inert extender in cheap paints; in grey fillers and stoppers, flooring compositions, linoleum and rubber mixes; in artificial stone and cement **Standard**: India IS 61	**19**
Insol	Unalt	V. good (slight change)	Insol	—	—	—	—	Mainly in paints and lacquers with high infra red emission	**20**
Insol	Insol	Insol	Insol	—	Good	Bleeds	—	Mainly in paints	**21**
Insol	Unalt	Unalt	Insol	Insol	Insol	None	None	In lacquers and paints. Useful for grey hues in admixture with C.I. Pigment White 6 (Titanium dioxide) (only very slight floating and free from flocculation). Used in PVC, polystyrene, polyethylene, acrylic and unsaturated polyester resins	**22**

C.I. Pigment White 1—3

C.I. Pigment White	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C	Stability °C
1	77597	Inorganic		Insoluble in organic solvents							Excellent	—	Stable to 230
2	77633	Inorganic		Insoluble in organic solvents							Excellent	977	Stable to very high temperature
3	77630	Inorganic		Insoluble in organic solvents							Excellent	—	Excellent

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment White
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Insol	Insol	Decomposed with evolution of carbon dioxide	Insol	—	—	—	—	**White Lead.** Used as a pigment from ancient times (Greek 'Psmithium', Roman 'Cerussa') Very widely used in exterior and protective oil paints, having great value as a primary coat for wood: it is the most weather stable pigment available for paints. In use it is frequently toned, e.g. with C.I. Pigment Black 11 but is discoloured brown by hydrogen sulphide It is not used in emulsion paints or distempers Refractive Index 2·0 Because of its toxicity special precautions must be observed in its use (see e.g. Lead Paint (Protection against Poisoning) Act, 1926) *Note*: 'Genuine White Lead' is defined by BS 239:1952. Mixtures of White Lead with Barytes (or sometimes with other extenders) are 'Reduced White Lead'. For use of Lead Carbonate as pigment see C.I. 77596	1
				Standards BS 239:1952 Genuine White Lead for paints USA ASA K 23·1; Fed. Spec. TT–W–251b (2) Argentine IRAM 1009 Australia K 9 and 10 Belgium NBN 140 Canada I–GP–9, 9d France T 31–005 Holland N 680, 878 and 888 India IS 34 Mexico K 37 Poland C 624 S. Africa SABS 36–44 Spain UNE 1956 48039 Basic Sulphate of Lead. Characteristics and methods of test					
V. slightly soluble	(*NaOH*) Fairly soluble	Almost insoluble	Insol	—	—	—	—	**Basic Lead Sulphate.** In oil paints alone or in admixture with C.I. Pigment White 4 or other pigments, particularly C.I. Pigment Yellow 34 Also used for similar purposes to C.I. Pigment White 1 but has lower hiding power. It is less toxic and less liable to discoloration than C.I. Pigment White 1 **Literature:** *Thorpe*, **IX,** 627	2
				Standards BS 637:1952 Basic sulphate of lead for paints (incorporated in BS 239:1952) USA ASA 47–1; ASTM D82–44; Fed. Spec. TT–W–261a (2) (basic sulfate white lead); ASA 48; ASTM D405–41; Fed. Spec. TT–B–486 (2) (blue lead; basic sulfate)					
Similar fastness to C.I. Pigment White 2								**Lead Sulphate.** In hiding power (poor) differs markedly from C.I. Pigment White 2. Not used alone but extensively in admixture with Lead Chromes (C.I. Pigment Yellow 34). Also for the manufacture of neutral Lead Carbonate and thence of Lead Chromes	3

C.I. Pigment White 4—5

C.I. Pigment White	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
4	77947	Inorganic		Insoluble in organic solvents							Excellent	— / Excellent (Becomes yellow at high temperature but returns to white on cooling)
5	77115	Inorganic		Insoluble in organic solvents							Excellent	— / Unaffected

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment White
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Insol	Insol (*NaOH* 10%) dissolves hot	Dissolves	Insol	—	—	—	—	**Zinc Oxide.** Primarily and very greatly used in gloss paints and enamels; also in tinprinting, wallpaper and in size colours. It reacts with acid media and is liable to form gels which set hard but for the same reason is a valuable constituent in mixtures because of its ability to neutralise acid decomposition products from the vehicle: because of its opacity to ultraviolet light it gives some protection against it A very large amount is used in rubber manufacture Used in ceramics (both glazes and pigments) and in glass manufacture Has important uses in pharmaceutical and cosmetic preparations; in temporary dental fillings; and in soap making C.I. Pigment White 4 is used in admixture with C.I. Pigment Black 16 (zinc dust) in anti-corrosion paints. **Leaded Zinc Oxide** is an intimate combination of C.I. Pigment White 4 with C.I. Pigment White 2 The different grades of zinc oxide are sold under colour 'Seals', viz. white, green, red, yellow and blue. 'White Seal' has the highest purity and 'Green' and 'Red' are only slightly less pure **Literature** McNaughton, *J. Oil Col. Chem. Ass.*, **20** (1937), 330 Kekwick and Pass, *ibid*, **21** (1938), 118 Robertson, *ibid*, **25** (1942), 53 Bailey and Pass, *ibid*, **36** (1953), 171	**4**
				Standards BS 254:1952 Zinc Oxide (Types 1 and 2) for paints (incorporated in BS 239:1952); BS 2876:1957 USA ASA K 22·1; Fed. Spec. TT–Z–301 (2); ASTM D79–44 Argentine IRAM 1003 Australia K 17 and 18 Belgium NBN 248 Canada 1–GP–11 France T 31–006 Holland N 598, 680 and 877 Hungary MNOSZ 813 India IS 35 Japan JIS K 5102, K 1410:1962 Poland PN C 615 Roumania STAS 421 S. Africa SABS 89 Spain UNE 1956 48041 Sweden SIS 1600 13, 1604 02 *Leaded Zinc oxide* BS 1481:1952 USA Fed. Spec. TT–Z–321a; ASTM D80–41 India IS 36						
Insol	—	Dissolves (Hydrogen Sulphide evolved)	Insol	—	—	—		**Lithopone.** Widely used in paints and enamels, particularly for interior use, and emulsion paints and distempers; also in linoleum and leather cloth, rubber and cement. Very largely used as an extender for other pigments In chemical constitution it is a mixed precipitate of C.I. Pigment White 7 and C.I. Pigment White 22, heat treated Refractive Index 1·84 **Literature** Rigg, *J. Oil Col. Chem. Ass.*, **39** (1956), 809 *Thorpe*, **IX**, 627	**5**
				Standards BS 239–296:1967 Lithopone for paints USA Fed. Spec. TT–L–426 Argentine IRAM 1004 Australia K 20 Belgium NBN 265 and suppl. Holland N 680, 879 and 880 Hungary MNOSZ 814 India IS 37 Pakistan PS 108: 1960 Poland PN C81016 Yugoslavia JZS H.CI. 021					

C.I. Pigment White	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
6	**77891**	Inorganic	—	Insoluble in organic solvents							Excellent but liable to cause fading of organic dyes	— / Excellent
7	**77975**	Inorganic	—	Insoluble in organic solvents							Luminescent	1020 (sublimes at 1180) / Unaffected
8	**77847**	Inorganic	—	Insoluble in organic solvents							Luminescent	— / —
9	**77245**	Inorganic	—	—	—	—	—	—	—	—	Luminescent	— / —

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment White
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Insol	Unalt	Unalt	Insol	—	—	—	—	**Titanium Dioxide.** In paints, alkyd resin enamels, acid resistant enamels, NC, spirit and oil lacquers, emulsion paints. Also in paper surfacing, plastics and vinyl products, rubber, ceramics and cosmetics, soap and artists' colours. Widely used as a delustrant for artificial fibres C.I. Pigment White 6 is marketed in two crystal forms. Anatase type and Rutile type. Each of these types may be modified by the application of hydrous oxide end treatments during their manufacture. The end treated pigments are generally more stable as dispersions and the Rutile types which contain alumina, silica and zinc oxide offer a high order of chalking resistance in paint and enamel films exposed to the weather Rutile types are higher in specific gravity and, due to their higher refractive index, offer greater opacity than Anatase types. Rutile types also produce paints less subject to chalking; but Anatase types are generally bluer and less abrasive than Rutiles Refractive Index: 2·55–2·7 **Literature** Rutter, *J. Oil Col. Chem. Ass.*, **28** (1945), 187 Tinsley and Bowman, *ibid*, **32** (1949), 233 Richmond and Watson, *ibid*, **35** (1952), 162 Hughes, *ibid*, 535 Taylor, *ibid*, **38** (1955), 233 Campbell, *ibid*, **38** (1955), 550	**6**
								Standards BS 1851:1952 (incorporated in BS 239:1952) Titanium dioxide pigments for paints USA ASA K 45, ASTM D82–44; Fed. Spec. TT–T–425 (2) Anatase—Fed. Spec. TT–P–442b, Type I ASTM Spec. D–476–68, Type I Rutile—Fed. Spec. TT–P–442b, Type II ASTM Spec. D476–68, Type II Semi-Chalk Resistant—Fed. Spec. TT–P–442b, Type III ASTM Spec. D476–68, Type III Highly Chalk Resistant—Fed. Spec. TT–P–442b, Type IV Argentine IRAM 1005 Australia K 51 and 52 Canada I–GP–15 Holland N 1330 India IS 411; IS 1964 2851 Titanium dioxide for cosmetic industry Uruguay UNIT 46–50	
V. good (almost insol)	(*NaOH*) Soluble	Soluble (Hydrogen sulphide evolved)	—	—	—	—	—	**Zinc Sulphide.** In paints and enamels for interior use, printing inks, lacquers used alone or, more frequently, with other white pigments. It reacts with free resin acids and thickens Used as a luminescent pigment Also used as a filler for paper, as a white pigment for celluloid, and in cosmetics Refractive Index: 2·37 **Literature** *BIOS*, 814, 65	**7**
								Standards BS 1316:1946 Fluorescent and Phosphorescent Materials Type A of BS 1316:1946 having high brightness during and immediately after excitation, relatively short afterglow and good resistance to weather Poland, PN C81015	
Fastness similar to that of **C.I. Pigment White 7**								**Strontium sulphide.** In luminescent paints Inherent brightness lower than that of C.I. Pigment White 7 but duration longer: resistance to weather much lower **Literature**: *BIOS* 814, 65	**8**
								Standard Type B of BS 1316:1946	
Fastness similar to that of **C.I. Pigment White 7**								**Calcium sulphide.** In luminscent paints As a phosphorescent pigment has initial brightness lower than that of C.I. Pigment White 7 but has a longer afterglow. Resistance to weather is rather higher than for C.I. Pigment White 8 **Literature**: *BIOS* 814, 65	**9**
								Standard BS 1316:1946 Fluorescent and Phosphorescent materials (Type C)	

C.I. Pigment White 10—17

C.I. Pigment White	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
10	77099	Inorganic	—	Insoluble in organic solvents							—	— / —
11	77052	Inorganic	—	Insoluble in organic solvents							Excellent	— / Stable but becomes yellower
12	77990	Inorganic	—	Insoluble in organic solvents							Excellent (Completely unaffected)	— / Unaffected
13	77128	Inorganic	—	Insoluble in organic solvents							—	— / —
14	77163	Inorganic	—	—	—	—	—	—	—	—	—	— / —
15	77861	Inorganic	—	—	—	—	—	—	—	—	—	— / —
16	77625	Inorganic	—	Insoluble in organic solvents							—	— / —
17	77169	Inorganic	—	—	—	—	—	—	—	—	—	— / Decomposed at 260

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment White
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Insol	Insol	Dissolved	—	—	—	—	—	**Barium Carbonate.** Used a little as an extender of other pigments for paints but more frequently is produced *in situ* on lake making in order to assist soft texture. Also in enamels for ironwork, ceramics, glass manufacture and rubber. C.I. Pigment White 10 is poisonous and is used as a rat poison Refractive Index: 1·53 **Standards** BS 1795:1967 Precipitated Barium carbonate Japan JIS K1415:1961 Barium carbonate	10
Insol	(*NaOH*) 5% Soluble	Soluble	Insol	—	—	—	—	**Antimonious Oxide.** Primarily in paints, enamels and lacquers, being used for the most part in mixtures, especially with zinc oxide (C.I. Pigment White 4) and with titanium dioxide (C.I. Pigment White 6), in the latter case to control chalking. It has the advantages of being non-reactive with paint media and having a very high covering power. Used in vitreous enamels as an opacifier Refractive Index: 2·09–2·29 **Standards** BS 239–338:1967 Antimony Oxide for Paints USA Fed. Spec. TT–A–566 Australia K 50 Holland V 1337, NEN 1962:1942 (methods of test) India IS 38 Pakistan PS 109:1960 **Literature** Price, *J. Oil. Col. Ass.*, **26** (1943), 99	11
—	—	—	—	—	—	—	—	**Zirconium White.** Proposed as an alternative to C.I. Pigment White 1 but only used to any considerable extent in porcelain and enamel manufacture **Literature** Wagner, *Körperfarben*, 162	12
—	—	—	—	—	—	—	—	**Barium Tungstate.** Used as pigment in water, size and oil media **Literature** Wagner, *Körperfarben*, 197	13
Insol	—	Soluble	—	—	—	—	—	**Bismuth Oxychloride.** Chiefly in cosmetics	14
—	—	—	—	—	—	—	—	**Tin White.** In ceramics and in glass and vitreous enamels to increase opacity **Literature** Wagner, *Körperfarben*, 163	15
—	—	—	—	—	—	—	—	**Lead silicate.** In ceramics and in the fireproofing of fabrics	16
Insol	—	Soluble	—	—	—	—	—	**Bismuth White.** In cosmetics, though now largely replaced by C.I. Pigment White 4, and in medicine; also in ceramic enamels (imparts a colourless iridescent glaze to porcelain) Blackened by hydrogen sulphide	17

C.I. Pigment White	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
18	77220 (77713)	Inorganic	—	Insoluble in organic solvents							Excellent	— / Stable to 825
19	77005	Inorganic	—	Insoluble in organic solvents							—	— / —
20	77019	Inorganic	—	Insoluble in organic solvents							Unaffected	— / Stable to 700 (then loses some water)
21	77120	Inorganic	—	Insoluble in organic solvents							Unaffected	— / Stable to >1000
22	77120	Inorganic	—	Insoluble in organic solvents							Unaffected	— / Stable to >1000
23	77122	Inorganic	—	Insoluble in organic solvents							Excellent	— / Excellent

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment White
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticisers	PVC migration	Soap gel bleeding		
Insol	Unalt	Completely soluble	—	—	—	—	—	**Chalk, Whiting.** In water paints and distempers. Extensively used as an addition to other pigments in oil paints to neutralise acidity of media and to improve gloss; as a filler and in the manufacture of putty **Magnesite** (C.I. 77713) has a rather higher oil absorption than chalk and is little used in paints though some is used in matt finishes Refractive Index: 1·57–1·60 **Literature** *Thorpe*, **IX**, 630 *Research Association British Rubber Mnfrs* (1958) R 397, R 399 and R 406 Whiting and other forms of calcium carbonate as fillers for natural rubber	18
				Standard BS 1795:77220 precipitated calcium carbonate, whiting India IS 63:1960 1685 Israel SI 410:1963 Pigments for paints: ground mineral calcium carbonate Spain UNE 48:179 Chalk and Calcium Carbonate pigments for the manufacture of paints					
Insol	Unalt	Unalt	Insol	—	—	—	—	**China Clay.** Very little used directly as a pigment. Used as a base or extender for water paste colours for wallpaper and paper staining; also in size colours usually mixed with other pigments, e.g. C.I. Pigment White 18 Raw materials for ceramics. Widely used in paper manufacture for loading and surfacing	19
				Standards BS 1795:1967 Extenders for paints India IS 68:1092 (China clay for textile and paper industries); CDC(896) Kaolin for cosmetic industry					
Insol	Unalt	Unalt	—	—	—	—	—	**Mica.** As an extender in paints for its leafing properties and covering power; to import lustre to wallpaper and other surfaces and as a filler in rubber and plastics. The material so used is the ground-up waste from the mining of mica and its preparation for other purposes especially for its use in the electrical industry which depends upon its extremely low conductivity Refractive Index: 1·58	20
				Standards BS 1795:1965 *Mica* USA ASTM D607–42 *Mica* USA ASTM D716–45 *Pumice* Spain UNE 48:176 (Mica for paints and enamels)					
Insol	Unalt	Unalt	Insol	—	—	—	—	**Blanc Fixe.** Extensively used in paints, especially in admixture with other pigments, and as base for striking lakes, especially for printing inks. Although almost transparent in oil it possesses considerable opacity in water and is used in water paints. Finer and softer than C.I. Pigment White 22 and relatively more transparent in oil but more opaque in water. Also used in paper loading and coating Refractive Index: 1·63	21
				Standards BS 1795:1965 Precipitated barium sulphate Argentine IRAM 1008 and 1010 Chile INDITECNOR 1960–39–8d and 39–9 India IS 64 and 65 Holland NEN 1962:1943 (methods of test for barium sulphate) Poland PN C 607					
As for C.I. Pigment White 21								**Barytes.** Naturally occurring barium sulphate with similar uses to C.I. Pigment White 21	22
Insol	Unalt (*NaOH* 10%) Alumina extracted	Alumina extracted	Insol	—	—	—	—	**Alumina—Blanc Fixe.** Chiefly as a base or extender for the preparation of colours for high gloss printing inks. Also used in paints, rubber and in high gloss paper surfacing. Hiding power is poor. Reactive to media containing a high fatty acid content	23

C.I. Pigment White 24—33

C.I. Pigment White	C.I. Constitution No.	Chemical Class	Hue	FASTNESS								
				ORGANIC SOLVENTS							Light	Heat
				Aliphatic petroleum	'Cellosolve'	Esters	Ethanol	Ketones	NC solvents	Xylene		m.p. °C / Stability °C
24	77002	Inorganic	—	Insoluble in organic solvents							Excellent	— / Excellent
25	77231	Inorganic	—	Insoluble in organic solvents							—	— / —
26	77718 (77019)	Inorganic	—	Insoluble in organic solvents							Unaffected	— / Unaffected
27	77811	Inorganic	—	Insoluble in organic solvents							Unaffected	— / Unaffected
28	77230	Inorganic	—	—	—	—	—	—	—	—	—	— / —
29	—	Inorganic	—	Insoluble in organic solvents							—	— / —
30	77622	Inorganic		—	—	—	—	—	—	—	—	— / —
31	*77163* (variation)	Inorganic		—	—	—	—	—	—	—	—	— / —
32	77964	Inorganic		—	—	—	—	—	—	—	—	— / —
33	77235	Inorganic		—	—	—	—	—	—	—	—	— / —

FASTNESS								MAJOR USAGE ADDITIONAL INFORMATION	C.I. Pigment White
Water	Na_2CO_3 5%	HCl 5%	Linseed oil	Oleic acid	Plasticiers	PVC migration	Soap gel bleeding		
Insol	(*NaOH* 10%) dissolved completely	Dissolved completely	Insol	—	—	—	—	**Aluminium Hydrate.** Used as an extender for the preparation of high-class lakes for transparent printing inks. Also as pigment for printing inks, paints (as filler and thickening agent) rubber (as filler); in leathercloth and paper surfacing. Reactive to media containing a high fatty acid content Refractive Index: 1·5	24
Appreciably soluble	—	—	—	—	—	—	—	**Gypsum.** Used as cheap extender for coloured pigments. Unsuitable for use in paints to be applied to steel as it causes corrosion. Widely used in fillers and plasters and in paper manufacture Refractive Index: 1·59	25
Insol	Unalt	Unalt	Insol	Insol	—	—	—	**Asbestine, Talc.** Asbestine used essentially as a substrate: absorbs Basic dyes, used as an extender for pigments for paints, including protective paints for structural steel, and assists suspension properties. Also used in rubber and ceramics. Talc is used as an absorbent substrate for Basic dyes, as a filler and in cosmetics **Standards** BS 1795:1967 Extenders for paints USA Fed. Spec. TT–M–90 Chile INDITECNOR 39–10 Talc for paint manufacture; 39–11 Talc for paint manufacture, sampling and methods of test India IS 66; CDC 3(894) Talc for cosmetic industry **Literature** Düssel, *Chem. Ztg.*, **48** (1924), 179 Hudson and Stanners, *J. Appl. Chem.*, **5** (1955), 173	26
Insol	Unalt	Unalt	Insol	Insol	—	—	—	**Silica.** Mixed with other white pigments in paints especially flat wall and undercoat paints: has advantage of good non-settling properties As base for lake making when transparency is required The mixture with silicon carbide has been used as an inert filler with red lead in anticorrosion paints Refractive Index: 1·55 **Standards** BS 1795:1952 Extenders for paints India IS 67	27
—	—	—	—	—	—	—	—	As a white filler in paper to replace C.I. Pigment White 6 when fluorescent brightening agents are used	28
Insol	Unalt	Unalt	Insol	Insol	—	—	None	Textile printing; in discharge print pastes containing reducing agents and thickeners, in synthetic resin emulsion binders	29
—	—	—	—	—	—	—	—	Used as substitute for Pearl Essence (C.I. Natural White 1)	30
—	—	—	—	—	—	—	—	Chemical constitution and usage similar to that of C.I. Pigment White 14	31
—	—	—	—	—	—	—	—	Zinc phosphate. As a corrosion inhibitor in phosphatising and in anti-corrosion paints, especially in combination with C.I. Pigment Yellows 36 and 120	32
—	—	—	—	—	—	—	—	Similar to that of C.I. Pigment White 25 **Literature:** Feldmühle A.G. *BP* 1128795	33

C.I. Pigment Metal 1—6

C.I. Pigment Metal*	C.I. Constitution No.	PROPERTIES	USAGE	LITERATURE AND STANDARDS
1	**77000**	As produced in the form of platelets has good leafing properties and opacity and produces films of very high hiding power with high reflectance for light and heat Specific Gravity (powder) 2·5–2·6	**Aluminium, Aluminium Bronze.*** In oil, resin or NC media. Used in paint for either wood or metal especially in primer coats protective against moisture and in final coats for storage vessels, etc. to minimise heat absorption or losses: also in polychromatic paints and finishes for motor cars. It may be tinted with organic pigments	**Literature** *Thorpe*, **IX,** 641 Wray, *Protective and Decorative Coatings, Mattiello*, **II**, 555 Edwards and Wray, *Aluminium Paint and Powder*, New York, Reinhold Publishing Corp., 3rd Edit. 1955 **Standards** BS 388:1964 Aluminium Flake Pigments (Powder & Paste) for Paints ASTM D962–49 Aluminium Pigments (Powder & Paste) for Paints ASTM D480–51 Aluminium Powder & Paste, Sampling and Testing Canada I–GP–22c, I–GP–24c France AFNOR 1965 T–31–009 Aluminium pigments in paste form for paints
2	**77400**	Has good leafing properties (Copper Bronze) providing the medium is correctly selected. The drying rates of oil media are retarded by metallic copper	**Copper, Copper Bronze.** Used in marine and anti-fouling paints, decorative paints and other compositions for indoor use and printing inks. "Gold Bronze" is used as a cheap substitute for gold	**Literature** Tuwiner, Noel, *Protective and Decorative Paints, Mattiello*, **11**, 576 **Standards** ASTM D964–48T Copper Powder for Use in Anti-fouling Paints ASTM D267–41 Gold Bronze Powder
3	**77480**	The most malleable of all metals and capable of being beaten out to extremely thin **Gold Leaf.** It is quite unaffected by water, air or oxygen, or by most reagents	**Gold. Gold Leaf Flake** is used for colouring glass red, for decorating glass or porcelain and in artists' colours for illumination and in gilding. **Gold Purple** (or **Purple of Cassius**) is a colloidal suspension of metallic gold and stannic oxide and is used in the manufacture of red artificial gems, coloured glass, porcelain and enamel	**Literature** *Thorpe*, **VI,** 122 Haber, *Phys. Z.*, **25** (1924), 45 See also C.I. Pigment Red 109
4	**77575**	Lead powder has good anti-corrosion properties in paints but is difficult to keep in suspension	**Lead.** The fused metal is applied to steel by spraying to provide an anti-corrosion surfacing. It is used alone as a primer on other metals (lead, stainless steel, aluminium, magnesium) and in admixture with aluminium flake in protective paints	**Literature** Harlan, *Protective and Decorative Coatings, Mattiello*, **II**, 603
5	**77860**	As a protective coating for metals tin has the advantage of ready formation of intermetallic compounds, resistance to corrosion and non-toxicity	**Tin.** Particularly well suited for coating food containers and is used in enormous quantities for this purpose, being applied to the metal by electro-deposition (tin plate) or by dipping in or spraying with the molten tin As **Tin Powder** is sometimes used in paint or lacquer when a 'whiter' metallic effect is required than is given by Aluminium Bronze (**C.I. Pigment Metal 1**). Used to give a 'silver' surface to paper by applying on a casein base and then burnishing	**Literature** *Thorpe*, **XI,** 618 Noel, *Protective and Decorative Coatings, Mattiello*, **II**, 600
6	**77945**	**Zinc Dust**, which contains a small percentage of Zinc Oxide (**C.I. Pigment White 4**), has high hiding power and combines the mild neutralising properties of zinc oxide with the inhibiting properties of metallic zinc	**Zinc.** The metal is used in great quantity for the protective galvanising of iron and steel **Zinc Dust** is used, mixed with **C.I. Pigment White 4,** in protective paints for metal surfaces and as a primer for other metallic paints because it gives improved adherence to zinc surfaces such as that of galvanised steel. Also used in decorative paints, its opacity being a particularly useful property	**Literature** Nelson, *Protective and Decorative Coatings, Mattiello*, **II,** 382 Remington and Francis, *Pigments, their Manufacture, Properties and Use* Chatfield, *Paint and Varnish Manufacture*, 270 **Standards** BS 3982 Zinc dust pigment USA Fed. Spec. TT–Z–291 (2) (Zinc dust); ASTM D520–51 Zinc Dust (Metallic Zinc Powder); ASTM D521–50T Zinc Dust (Metallic Zinc Powder), methods of Chemical Analysis

*The term **Bronze** is used in the paint and allied industries as a generic term for metal powders in flake form used as pigments. Some of the commercial "Bronzes" consist of metal alloys.

APPENDIX

Water-insoluble, or sparingly soluble, salts of Textile dyes used as Pigments

In the Preamble (p.3267) it is mentioned that in addition to those pigments given C.I. Pigment references there are some others, consisting of salts of water-soluble dyes, which have a more limited use. The dyes principally concerned are listed below under their C.I. Generic Names. The pigments derived from Acid and Direct Dyes consist of alkaline earth metal salts, most frequently Calcium or Barium salts, and occasionally salts formed with metals of other groups. The pigments derived from Basic Dyes consist of salts formed between the dyes and certain specially chosen organic and inorganic acids. Certain of the pigments formed between Basic dyes and the high molecular weight Phosphotungsto-molybdic acid (PTMA), Phosphotungstic acid (PTA) and Phosphomolybdic acid (PMA) have considerable commercial importance and are included in the preceding pages as C.I. Pigments but a variety of pigments of less importance are made by using Basic dyes with other inorganic or organic acids as precipitants.

Certain of the pigments given C.I. Generic Names are chemically equivalent to C.I. Vat Dyes and differ from them only in physical form. Cross references to these are given in the details of both the Pigment and Vat Dyes sections.

YELLOW DYES WITH PIGMENT APPLICATIONS

C.I. Acid Yellows 1, 3, 4, 5, 7, 8, 9, 11, 13, 15, 17, 21, 23, 27, 31, 34, 36, 37, 42, 46, 56, 58, 60, 63, 70, 71, 72, 132, 153

C.I. Basic Yellows 1, 2, 3, 4, 6

C.I. Direct Yellows 6, 8, 11, 12, 17, 49, 54, 99

C.I. Natural Yellows 2, 9, 11, 14, 15, 21, 23

ORANGE DYES WITH PIGMENT APPLICATIONS

C.I. Acid Oranges 1, 8, 11, 14, 16, 17, 23, 31, 45, 58, 76

C.I. Basic Orange 14

C.I. Direct Oranges 15, 34, 53

RED DYES WITH PIGMENT APPLICATIONS

C.I. Acid Reds 1, 4, 14, 17, 24, 25, 26, 27, 30, 32, 37, 45, 51, 65, 66, 73, 87, 89, 93, 95, 97, 106, 110, 115, 123, 135, 138, 184, 212

C.I. Basic Reds 1, 2, 3, 8, 12

C.I. Direct Reds 1, 23, 24, 79, 83, 89, 113

C.I. Natural Reds 4, 6, 8, 9, 27

VIOLET DYES WITH PIGMENT APPLICATIONS

C.I. Acid Violets 9, 12, 15, 17, 21, 22, 67

C.I. Basic Violets 1, 2, 4, 10, 11, 13, 14

C.I. Direct Violets 7, 48

BLUE DYES WITH PIGMENT APPLICATIONS	
C.I. Acid Blues	1, 3, 5, 7, 9, 11, 15, 17, 19, 22, 24, 43, 45, 47, 59, 61, 67, 84, 86, 88, 93, 97, 103, 104, 108, 109, 110, 112, 119
C.I. Basic Blues	3, 5, 7, 8, 9, 11, 25, 26
C.I. Direct Blues	1, 22, 70, 86
C.I. Natural Blue	2
GREEN DYES WITH PIGMENT APPLICATIONS	
C.I. Acid Greens	2, 3, 4, 5, 6, 8, 9, 22, 41
C.I. Basic Greens	1, 4
C.I. Direct Green	6
C.I. Natural Green	3
BROWN DYES WITH PIGMENT APPLICATIONS	
C.I. Acid Brown	49
C.I. Basic Browns	1, 4
C.I. Direct Browns	2, 31, 38, 58, 95, 112, 166
C.I. Natural Browns	8, 9, 11
BLACK DYES WITH PIGMENT APPLICATIONS	
C.I. Acid Blacks	10, 24
C.I. Natural Blacks	3, 6
WHITE COLOURING MATTER WITH PIGMENT APPLICATION	
C.I. Natural White	1

REACTIVE DYES

The first reactive dyes for cellulosic fibres appeared on the market in 1956. They could not be included in the 2nd Edition of the *Colour Index*, published that year, but a new usage group was established for them in the 1963 *Supplement*.

In seeking easily applied dyes of high fastness to wet treatments chemists long had in mind the possibility of producing dyes capable of chemical combination with textile fibres and having adequate stability under ordinary conditions of storage and application. It was generally believed, however, that reaction with cellulose would require severe conditions likely to damage the fibre structure; reaction with animal fibres appeared less difficult, but their sensitivity to alkali had to be taken into account. Success was first achieved by I. D. Rattee and W. E. Stephen of Imperial Chemical Industries Ltd., who found that dyes containing a dichlorotriazinylamino substituent can be applied to cotton and other cellulosic fibres under mildly alkaline conditions, and that the dyes become attached to the fibre by chemical union with the cellulose molecule. Such dyes were not new, but application by means of a reaction of the Schotten-Baumann type had not previously been performed. It is necessary to bring about reaction with only a few of the many hydroxyl groups in the fibre (even for deep dyeings), and mild conditions are quite suitable for this purpose.

The dichlorotriazinyl group is readily introduced into the molecules of amino-substituted dyes of many chemical types by reaction with cyanuric chloride, and the derivatives obtained are often so reactive that they can be applied to cellulosic fibres by a cold dyeing process. The second of the two chlorine atoms is less readily replaced than the first, and if at some stage of manufacture of the dye one of them is removed by reaction with a compound such as an aromatic or aliphatic amine, a phenol or an alkoxide a monochlorotriazinyl derivative is obtained with lower reactivity than that of the corresponding dichlorotriazinyl compound; such a dye can still react readily with cellulosic fibres, but requires hot application. Monochlorotriazinyl dyes are of value not only for dyeing but especially for textile printing because of their good stability in printing paste.

In presence of alkali dyes of both types become attached to the fibre by covalent bonds, and as the dye and fibre then form a single chemical entity the coloured product is highly resistant to wet treatments. Since fibre structure is not significantly affected the change in fibre qualities is negligible.

The dyes resulting from the work of Rattee and Stephen were marketed by ICI as the *Procion M* (cold dyeing) and *Procion H* (hot dyeing) ranges. Their success soon attracted the interest of other manufacturers, who immediately began extensive programmes of research in this field. It was found that many other reactive systems can be applied similarly, and some of them have been utilised in marketed ranges of dyes. Most of the newer systems have lower reactivity than the dichlorotriazinylamino dyes, and with few exceptions the dyes need hot conditions for application.

Reaction with cellulose may take place either by nucleophilic substitution, giving cellulose esters, or by nucleophilic addition, giving cellulose ethers. The following are examples of reactive groups that have been used in commercial ranges (usually protected by patents):

Monochlorotriazinyl
Dichlorotriazinyl
2,4-Dichloropyrimidinyl
2,4,5-Trichloropyrimidinyl
2,3-Dichloroquinoxaline-6-carbonyl
4,5-Dichloro-6-pyridazonylpropionyl
1,4-Dichlorophthalazine-6-carbonyl
Chlorobenzothiazole (linked to the dye molecule via –CONH–, $-SO_2NH-$, –NH– or –N=N–)
5-Chloro-4-methyl-2-methylsulphonylpyrimidinyl
Vinylsulphonyl
β-Sulphatoethylsulphonyl
β-Sulphatoethylaminosulphonyl
β-Chloroethylsulphonyl
β-Sulphatopropionamido

Most of these groups react by nucleophilic substitution. The vinylsulphonyl group undoubtedly reacts by nucleophilic addition, and evidence has been published favouring a similar mechanism for the reaction of the last four groups in the list (the corresponding vinyl derivative being formed in an intermediate stage). Some chemists believe, however, that reaction takes place at least partly by nucleophilic substitution.

The presence of a covalent link between cellulosic fibres and reactive dyes of several classes has been established by a variety of experimental methods. The original literature must be consulted for details, but a summary of some of the principal evidence relating to dyes containing mono- and dichlorotriazinylamino groups follows; the existence of a covalent link with dyes of other types has been shown by similar means, and by a method described in refs. 40 and 42.

1. When dyes containing mono- or di-chlorotriazinylamino groups are applied to cotton fibres from a neutral bath the dyeings have poor washing fastness, but fixation is brought about by treating the dyed fibre with alkali, and the dyes cannot then be removed in a boiling soap bath.
2. Reactive dyes fixed on cellulosic fibres with alkali cannot be removed by extraction with boiling pyridine, *o*-chlorophenol or chloroform; on the other hand direct, vat and azoic dyes are stripped by such treatments.
3. Cellulose dyed with dyes containing dichlorotriazinylamino groups loses its normal solubility in cuprammonium hydroxide solution.
4. If cotton dyed with certain monoazo dyes containing dichlorotriazinylamino groups is treated with sodium hydrosulphite the dye is split into two colourless amino-substituted components; one of these remains anchored to the fibre by the covalent bond still present, and the amino group can be diazotised and coupled with an amine or phenol to yield a new dye with high wet-fastness properties.

Not all dyes described by their makers as reactive have been conclusively shown to form a link with the fibre, and it has been suggested that some of them are fixed by self-condensation or the elimination of solubilising groups. No

attempt to resolve such doubts is made in the *Colour Index*, but classification is normally based on information supplied by manufacturers.

The *Basazol* dyes (BASF) are included in the C.I. Reactive Dyes section although they do not react directly with the fibre; their fixation depends on the use of a cross-linking agent capable of reacting with both the fibre and the dye.

Most reactive dyes are hydrolysed to some extent during application, and the resulting hydroxy derivatives are no longer able to react with cellulose. Some affinity for the fibre remains, but hydrolysed dyes have low fastness to wet treatments. It is therefore necessary to remove unfixed dye by means of a bath containing soap or other detergent. Reaction takes place mainly with the fibre rather than with water, however. Several factors account for this, and probably the most important of them is the rapid adsorption of dye molecules by the fibre, which brings the reacting groups into proximity; other factors have been discussed by Preston and Fern (ref. 35) and Zollinger (refs. 44, 54). In order that a reactive dye may be adsorbed by cellulose it must have some substantivity, but if this is very great the hydrolysed fraction is likely to have similar properties in this respect, and is then difficult to wash out. It follows that there is an optimum value for the cellulose-substantivity of reactive dyes for application by dyeing. For printing, when the dye is applied mechanically in suitable concentration, the necessary substantivity is much lower.

The marketed reactive dyes vary in reactivity, stability in solution, stability of the dye–fibre bond in specified conditions, efficiency of fixation and the ease with which the hydrolysed dye is removed from the fibre. Dyes are therefore selected for particular applications in accordance with their properties. Some of the more recent dyes show marked improvements in fixation efficiency.

Reactive dyes have a great advantage over direct dyes in that they do not need to conform to structures conferring affinity for cellulose. Their molecules are usually fairly simple, and consequently their spectra contain narrow absorption bands with high peaks, and the dyed hues are bright. A further advantage arising from the small molecular size is rapid diffusion through the fibre, and this allows application to be completed rapidly.

The reactivity of certain dyes may be increased by adding suitable tertiary amines to the dyebath; effective agents include pyridine, trimethylamine, *N*,*N*-dimethylhydrazine and 1,4-diazabicyclo-2,2,2-octane. Many commercial dyes may be applied to cellulosic fibres in conjunction with a crease-resist finish.

APPLICATION METHODS

Cellulosic Fibres

Dyeing—The processes used vary widely, but fall broadly into batchwise, semi-continuous (or pad–batch) and continuous types. Fixation is effected by means of a variety of alkaline treatments, the temperature used depending on the reactivity of the dye in use. Unfixed dye is removed afterwards in a detergent bath, and finally the dyed material is rinsed with water. Outlines of conventional processes are provided on p.3393 in the 'Explanation of the Tables'.

Printing—In direct processes reactive dyes are often printed as a thickened aqueous solution containing urea and sodium carbonate or bicarbonate; the printed fabric is then dried, and the dye is fixed by steaming or baking. Highly reactive dyes may be printed with or without sodium bicarbonate; then the fabric is dried, padded with alkali, and dried on a cylinder. A very simple process is in use in which these dyes are printed on alkali-prepared cloth and development is brought about by hanging in air. In all these processes the printed fabric is well washed to remove unreacted dye, thickening, etc., and finally dried. Various resist and discharge processes are in use, and there are also more complex processes in which reactive dyes are applied together with azoic or solubilised vat dyes or pigment printing compositions.

Thickening agents must obviously be unreactive, and usually consist of sodium alginate or a hydrocarbon emulsion.

Wool

Several years before the appearance of reactive dyes for cellulosic fibres Farbwerke Hoechst introduced the *Remalan* dyes for wool, but although they contained reactive groups their reactive character received little attention, and they were classified as C.I. Acid Dyes; some of them have since been transferred to the C.I. Reactive Dyes section. The first specifically reactive dyes for wool were marketed as the *Procilan* range by ICI in 1963. They are based on a reactive system differing from those used in cellulosic dyes, and it has the advantage of not being subject to hydrolysis in the dyebath. Ranges of reactive dyes for wool are now sold also by other firms.

Reactive dyes are normally applied to wool from neutral or weakly acid baths. In order to obtain maximum washing fastness prolonged boiling, dyeing under pressure, or a final pH of 8·0–8·5 may be required, but these more severe conditions may cause some damage to the fibre. Viable processes for application of dichlorotriazinylamino dyes (originally designed for cellulosic fibres) to wool are now available.

The impact of reactive dyes has been smaller in wool dyeing than in cotton dyeing because high wet-fastness properties were already attainable on wool by means of dyes of other classes.

Nylon

A range of reactive *Procinyl* dyes for nylon was introduced by ICI in 1959. They are applied in weakly acid conditions, under which reaction with the fibre does not occur, and level dyeings are readily obtained; on treatment with alkali, reaction with the fibre takes place and the resulting dyeings have high fastness to wet treatments. Free amino groups in the nylon fibre provide reactive sites, but there is some evidence suggesting that reaction may also occur with amide groups.

Other Fibres

Reactive dyes are used to a small extent on acetate and triacetate, and some can even be applied to polyester fibres; for these applications a classification as disperse rather than reactive dyes might sometimes be more appropriate.

Leather

Reactive dyes are especially suitable for application to leather intended for gloves and other garments required to withstand wet conditions and also dry-cleaning.

EXPLANATION OF THE TABLES

For the most part the tables are self-explanatory, but the following features should be noted.

Some of the more important methods for dyeing cellulosic fibres are indicated in the tables by symbols having the following significance:

Dyes with High Reactivity

1. Batchwise Processes
   (a) The dye is applied from a neutral bath containing salt or Glauber's salt; soda ash or other mild alkali is added for fixation.
   (b) The dye is applied from a neutral padding bath and then fixed by running the dyed fabric on a jig or winch into a bath containing salt or Glauber's salt with addition of soda ash or other mild alkali.
   (c) Viscose rayon is dyed from a bath at 50°C containing sodium bicarbonate with salt or Glauber's salt.
2. Pad (alkali)–Batch Processes
   (a) The dye is applied from a cold padding bath containing sodium bicarbonate, soda ash, sodium metasilicate or caustic soda; the dyed fabric is then batched for 1–24 hours at room temperature.
   (b) The dye is applied from a cold padding bath containing sodium bicarbonate, and then fixed in a Pad–Roll chamber at 55–65°C for 2 hours.
3. Continuous Processes
   (a) The dye is applied from a cold padding bath containing sodium bicarbonate, then fixed by means of dry heat (which may be followed by steaming for heavy dyeings) or by steaming the wet fabric for 15–60 sec.
   (b) The dye is applied by padding, and the dried fabric is then impregnated with a strong solution of salt containing caustic soda and steamed for 15–60 sec.
   (c) Dyeing is carried out in a Standfast molten metal machine, using the sequence:
   padding—impregnation with a strong solution of salt containing a strong alkali—heating—washing.

Dyes with Moderate Reactivity

4. Batchwise Processes
   (a) The dye is applied from a hot neutral bath containing salt or Glauber's salt; alkali is then added for fixation.
   (b) The dye is applied from a neutral padding bath and the dyed fabric is then treated on a jig or winch with a hot neutral solution of salt or Glauber's salt to which alkali is added later for fixation.
5. Pad (alkali)–Batch Processes
   (a) The dye is applied from a cold padding bath containing caustic soda, and the dyed fabric is then batched for 16–48 hours at room temperature.
   (b) The dye is applied from a bath at 20–50°C containing soda ash, and the dyed fibre is then batched in a Pad–Roll chamber at 80–85°C for 3–6 hours.
6. Continuous Processes
   (a) The dye is applied from a cold padding bath (preferably containing a migration inhibitor), then the goods are dried, impregnated with a cold saturated solution of salt containing 1% of caustic soda, and steamed for about 45–75 sec.
   (b) The dye is applied from a padding bath at 20–50°C containing urea, a reduction inhibitor and 2% sodium bicarbonate or soda ash; the goods are then dried and steamed for 3–8 minutes.
   (c) The dye is applied from a padding bath as in (b), and fixation is carried out by application of dry heat (e.g., heating at 110–200°C for 1–5 minutes).

When the available information does not conform to any of the processes described above, brief details of recommended methods are provided.

Fastness Properties

The headings in the tables are chosen to suit a variety of fibres, and appropriate figures are quoted.

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C.I. Reactive Yellow	1	2
CHEMICAL CLASS	Monoazo (pyrazolone)	Monoazo (pyrazolone)
REACTIVE SYSTEM	Dichlorotriazinyl	Monochlorotriazinyl
C.I. CONSTITUTION NO.	—	—
HUE		
Daylight	Bright Greenish Yellow	Bright Yellow
Artificial light (tungsten)	Redder	Redder
DYEING		
Cellulose	1 (a, b, c), 2 (a, b), 3 (a, b, c)	4 (a, b), 5 (a, b), 6 (a, b, c)
Nylon	Formic acid at 40→95°C	Formic acid
Silk	(Degummed): Na_2SO_4 at 50°C; soda ash added. Or formic acid at 40°C→85°C	—
Wool	Acid (for ingrain effects). Acetic acid + cationic agent for level dyeing	As for C.I. Reactive Yellow 1
PRINTING	Cellulose, silk and wool: with $NaHCO_3$, urea and a reduction inhibitor, with alginate or emulsion thickener; fixed by steaming (on wool $NaHCO_3$ is omitted).*	Cellulose: with $NaHCO_3$ or Na_2CO_3, urea and a reduction inhibitor, thickened with sodium alginate; fixed by steaming or dry heat. Silk and wool: as for cellulose, but $NaHCO_3$ is omitted on wool*

FASTNESS PROPERTIES

Fibre / Method	1 Cotton ISO	1 Nylon ISO	1 Silk ISO	2 Cotton ISO	2 Nylon ISO	2 Wool ISO
Alkali	3	—	—	3	6	—
Burnt Gas Fumes	—	—	—	—	—	—
Carbonising — Alkaline rinse	—	—	—	—	—	—
Neutral rinse	—	—	—	—	—	—
Decatising	—	—	—	—	—	—
Light — ⅓–½ normal	—	—	—	5–6	—	—
normal	6–7	6–7	5–6	6–7	—	6
2× normal	6–7	—	—	6–7	—	—
Peroxide Bleach — Alteration	2	4–5	3	3	4–5	—
Staining	—	—	—	—	—	—
Perspiration — Alteration	—	—	—	—	—	4–5
Staining	—	—	—	—	—	—
Soda Boil — Alteration	—	—	—	—	—	—
Staining	—	—	—	—	—	—
Washing — Alteration	2 (5×100°C)	5	5	3	4–5	4
Staining	—	—	—	—	—	—

OTHER PROPERTIES		
Dischargeability	Dischargeable to white	Suitable at all depths
Effect of Metals — Copper	4 (duller)	1 (redder and duller)
Iron	Unaffected	3 (redder)
Reactions in Substance		
H_2SO_4 conc.	—	—
Dilute HCl	—	—
Dilute NaOH	—	—
NON-TEXTILE USAGE		
NOTES	Solubility in water: very good *May also be printed on cellulose by nip padding with a thickened alkaline solution and fixed by drying on cylinders, baking at 100–110°C or air hanging Nylon: printed with a thickened solution containing thiourea, phenol and $(NH_4)_2SO_4$ and steamed Suitable for printing on C.I. Azoic Components 2 and 5	*Discharge and resist styles on cellulose Suitable for printing on C.I. Azoic Coupling Component 5 Printing on nylon: with thiourea, phenol and ammonium sulphate; steamed 30 min

C.I. Reactive Yellow	3	4
CHEMICAL CLASS	Monoazo	Monoazo
REACTIVE SYSTEM	Monochlorotriazinyl	Dichlorotriazinyl
C.I. CONSTITUTION NO.	—	—
HUE		
Daylight	Bright Reddish Yellow	Bright Reddish Yellow
Artificial light (tungsten)	Little redder	Little redder
DYEING		
Cellulose	4 (a, b), 5 (a, b), 6 (a, b, c)	1 (a, b, c), 2 (a, b), 3 (a, b, c)
Nylon	Formic acid	As for C.I. Reactive Yellow 1
Silk	(Degummed): Na_2SO_4 at 70–90° or formic acid at 40→85°; Na_2CO_3 added; soaped	
Wool	As for C.I. Reactive Yellow 1	
PRINTING	Cellulose, nylon, silk and wool: as for C.I. Reactive Yellow 2	Cellulose, nylon, silk and wool: as for C.I. Reactive Yellow 1

FASTNESS PROPERTIES

Fibre / Method	3 Cotton ISO	3 Nylon ISO	3 Silk ISO	3 Wool ISO	4 Cotton ISO	4 Nylon ISO	4 Silk ISO
Alkali	4	—	—	—	3–4	—	—
Burnt Gas Fumes	—	—	—	—	—	—	—
Carbonising — Alkaline rinse	—	—	—	—	—	—	—
Neutral rinse	—	—	—	—	—	—	—
Decatising	—	—	—	—	—	—	—
Light — ⅓–½ normal	5–6	—	—	—	6	—	—
normal	6–7	6	6	5	6	6–7	6–7
2× normal	6–7	—	—	—	6	—	—
Peroxide Bleach — Alteration	4–5	5	5	—	4–5	5	5
Staining	—	—	—	—	—	—	—
Perspiration — Alteration	—	—	—	4–5	—	—	—
Staining	—	—	—	—	—	—	—
Soda Boil — Alteration	—	—	—	—	—	—	—
Staining	—	—	—	—	—	—	—
Washing — Alteration	4–5	5	5	4–5	5	5	5
Staining	—	—	—	—	—	—	—

OTHER PROPERTIES	
Dischargeability	Suitable at all depths
Effect of Metals — Copper	3–4 (redder)
Iron	4–5
Reactions in Substance	
H_2SO_4 conc.	—
Dilute HCl	—
Dilute NaOH	—
NON-TEXTILE USAGE	
NOTES	Suitable for printing on C.I. Azoic Coupling Components 2 and 5

Suitable for printing on C.I. Azoic Coupling Components 2 and 5

5	6	7	C.I. Reactive Yellow
Azo	Monoazo	Azo	**CHEMICAL CLASS**
—	Monochlorotriazinyl	Dichlorotriazinyl	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Bright Yellow (nylon)	Yellow	Bright Reddish Yellow	**HUE** Daylight
Redder	Redder	Little redder	Artificial light (tungsten)
—	4 (a, b), 5 (a, b), 6 (a, b, c)	1 (a, b, c), 2 (a, b), 3 (a, b, c)	**DYEING** Cellulose
Acetic acid at 85–100°C; soda ash added for fixation*	—	As for C.I. Reactive Yellow 1	Nylon
—	—		Silk
—	As for C.I. Reactive Yellow 1		Wool
Nylon: with acetic acid, sodium acetate and sodium chlorate; steamed 30 min Acetate and triacetate: with urea + sodium chlorate; steamed 30 min	Cellulose, nylon, silk and wool: as for C.I. Reactive Yellow 2	Cellulose, nylon, silk and wool: as for C.I. Reactive Yellow 1	**PRINTING**

Nylon ISO	Acetate ISO	Triacetate ISO	Polyester ISO	Cotton ISO	Cotton ISO	**FASTNESS PROPERTIES** Fibre / Method
5	—	—	—	5	2 (redder)	Alkali
—	5	5	5	—	—	Burnt Gas Fumes
5	—	—	—	—	—	Carbonising — Alkaline rinse
—	—	—	—	—	—	Neutral rinse
5	—	—	—	—	—	Decatising
5	—	—	—	—	—	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
6	5–6	5	6	6*	5–6*	normal
6–7	6	5–6	6–7	6–7	6	2× normal
—	—	—	—	3 (redder)	4–5	Peroxide Bleach — Alteration
—	—	—	—	5	—	Staining
5	5	5	5	5	5	Perspiration — Alteration
—	4–5	5	5	4–5	4–5	Staining
—	—	—	—	—	—	Soda Boil — Alteration
—	—	—	—	—	—	Staining
5	5	5	5 (No.3)	4–5 (redder)	4–5	Washing — Alteration
—	5	5	5	4–5	—	Staining

Very good	Moderate white†	Unsuitable for discharge	**OTHER PROPERTIES** Dischargeability
Redder	3 (bluer, duller)	4–5 (duller)	Effect of Metals — Copper
Redder	4–5	4–5 (redder)	Iron
—	Unaffected	—	Reactions in Substance H_2SO_4 conc.
—	—	—	Dilute HCl
—	—	—	Dilute NaOH
			NON-TEXTILE USAGE
*Also for dyeing acetate, triacetate, polyester and modified acrylic fibres	*Fastness on nylon (ISO): light, 5–6 Fastness on silk (ISO): light, 6 †White in pale dyeings Suitable for printing on C.I. Azoic Coupling Components 2 and 5	*Fastness on nylon and silk (ISO): light, 6–7 Suitable for printing on C.I. Azoic Coupling Components 2 and 5	**NOTES**

C.I. Reactive Yellow	8	9	10
CHEMICAL CLASS	Azo	Monoazo	Monoazo
REACTIVE SYSTEM	Trichloropyrimidinyl	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Reddish Yellow	Reddish Yellow	Greenish Yellow
Artificial light (tungsten)	Little redder	—	—
DYEING			
Cellulose	Continuous, pad (alkali)-batch and batchwise processes		
Nylon	—		
Silk	Salt + Na_3PO_4 at 50→85°C		
Wool	Acetic acid + cationic agent at 50→100°C		
PRINTING	Cellulose: with urea + reduction inhibitor + Na_2CO_3 or $NaHCO_3$ + alginate or emulsion thickener; steamed or heated at 140–160°C. Discharge and resist styles*	Cellulose: alkaline solution thickened with an alginate or emulsion; fixed by neutral steaming or baking	Cellulose: as for C.I. Reactive Yellow 9 Also discharge printing
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	—	—	—
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	3–4	6	4–5
normal	4–5	6	5–6
2× normal	—	—	—
Peroxide Bleach — Alteration	5	4–5	4 (redder)
Staining	—	—	5
Perspiration — Alteration	3–4	—	—
Staining	5	—	—
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	4–5	4–5	4–5
Staining	5	—	—
OTHER PROPERTIES			
Dischargeability	4 (alkaline)	Not dischargeable	(Alkaline) very good
Effect of Metals — Copper	—	—	—
Iron	—	—	—
Reactions in Substance			
H_2SO_4 conc.	—	Yellowish red*	Greenish yellow*
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE			
NOTES	*Printed on wool from neutral or weakly acid paste and on silk with $NaHCO_3$; fixation by steaming in each case. Suitable for printing on C.I. Azoic Coupling Components	*On dilution: greenish yellow Fast to crease-resist finishing	*On dilution: yellow Fast to crease-resist finishing

11	12	13	C.I. Reactive Yellow
Monoazo (pyrazolone)	Monoazo	Monoazo	**CHEMICAL CLASS**
Trichloropyrimidinyl	Trichloropyrimidinyl	Vinylsulphonyl	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Bright Yellow	Bright Reddish Yellow	Bright Yellow	**HUE** Daylight
Redder	—	—	Artificial light (tungsten)
Continuous, pad (alkali)-batch and batchwise processes	Continuous, pad (alkali)-batch and batchwise processes	Padded with $NaHCO_3$ and urea; fixed by steaming or dry heat	**DYEING** Cellulose
—	—	—	Nylon
As for C.I. Reactive Yellow 8	As for C.I. Reactive Yellow 8	—	Silk
As for C.I. Reactive Yellow 8	As for C.I. Reactive Yellow 8	—	Wool
Cellulose, silk and wool: as for C.I. Reactive Yellow 8	Cellulose, silk and wool: as for C.I. Reactive Yellow 8	Cellulose: with $NaHCO_3$ and a neutral alginate thickener; fixed by neutral steaming Also discharge styles	**PRINTING**
Cotton ISO	Cotton ISO	Cotton ISO	**FASTNESS PROPERTIES** Fibre Method
—	—	3 (redder)	Alkali
—	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
—	—	—	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
6–7	5–6	5–6	normal
7	6	6	2× normal
2 (wash)	3–4 (wash)	—	Peroxide Bleach — Alteration
5	5	—	Staining
4–5	5	5	Perspiration — Alteration
5	5	5	Staining
—	—	—	Soda Boil — Alteration
—	—	—	Staining
4–5	5	5	Washing — Alteration
5	5	5	Staining
		Dischargeable to white	**OTHER PROPERTIES** Dischargeability
		—	Effect of Metals — Copper
		—	Iron
		—	Reactions in Substance H_2SO_4 conc.
		—	Dilute HCl
		—	Dilute NaOH
			NON-TEXTILE USAGE
Suitable for printing on C.I. Azoic Coupling Components Unaffected by crease-resist finishes	Suitable for printing on C.I. Azoic Coupling Components Unaffected by crease-resist finishes		**NOTES**

C.I. Reactive Yellow 14—19

C.I. Reactive Yellow	14	15	16
CHEMICAL CLASS	Monoazo	Monoazo	Monoazo (metal complex)
REACTIVE SYSTEM	Vinylsulphonyl	Vinylsulphonyl	Vinylsulphonyl
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Bright Yellow	Reddish Yellow	Dull Reddish Yellow
Artificial light (tungsten)	—	—	—
DYEING			
Cellulose	Padded with $NaHCO_3$ and urea; fixed by steaming or dry heat	Padded with $NaHCO_3$ and urea; fixed by steaming or dry heat	Padded with $NaHCO_3$ and urea; fixed by steaming or dry heat
Nylon	—	—	—
Silk	—	—	—
Wool	—	—	—
PRINTING	Cellulose: with $NaHCO_3$ and a neutral alginate thickener; fixed by neutral steaming Also discharge styles	Cellulose: with $NaHCO_3$ and a neutral alginate thickener; fixed by neutral steaming Discharge styles	Cellulose: with $NaHCO_3$ and a neutral thickener; fixed by neutral steaming Discharge styles
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	4 (redder)	2–3 (redder)	4 (redder)
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	—	—
normal	4–5	5	6–7
2× normal	5–6	6	7
Peroxide Bleach — Alteration	—	—	—
Staining	—	—	—
Perspiration — Alteration	4–5	5	5
Staining	5	5	5
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	4	5	4–5
Staining	5	5	5
OTHER PROPERTIES			
Dischargeability	Dischargeable to white	Dischargeable to white	Dischargeable to white
Effect of Metals — Copper	—	—	—
Iron	—	—	—
Reactions in Substance			
H_2SO_4 conc.	—	—	—
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE			
NOTES			

17	18	19	C.I. Reactive Yellow
Monoazo	Monoazo (pyrazolone)	—	**CHEMICAL CLASS**
Vinylsulphonyl	Monochlorotriazinyl	Dichloropyrimidinyl	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Bright Reddish Yellow	Bright Greenish Yellow	Bright Yellow	**HUE**
—	—	—	Daylight
			Artificial light (tungsten)
Padded with $NaHCO_3$ and urea; fixed by steaming or dry heat	4 (a, b), 5 (a, b), 6 (a, b, c)	As for C.I. Reactive Yellow 8	**DYEING** Cellulose
—	Formic acid (levelling: poor)	—	Nylon
—	—	As for C.I. Reactive Yellow 8	Silk
	Acid (for ingrain effects). Acetic acid + cationic agent for level dyeing	As for C.I. Reactive Yellow 8	Wool
Cellulose: with $NaHCO_3$ and a neutral thickener; fixed by neutral steaming Discharge styles	Cellulose, silk and wool: as for C.I. Reactive Yellow 2 Discharge and resist styles	Cellulose, silk and wool: as for C.I. Reactive Yellow 8	**PRINTING**
			FASTNESS PROPERTIES
Cotton ISO	Cotton ISO		Fibre Method
4–5 (redder)	3–4		Alkali
—	—		Burnt Gas Fumes
—	—		Carbonising — Alkaline rinse
—	—		Neutral rinse
—	—		Decatising
5–6	6*		Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
6	6		normal
			2× normal
—	4 (redder)		Peroxide Bleach — Alteration
—	5		Staining
5	5		Perspiration — Alteration
5	4–5		Staining
—	—		Soda Boil — Alteration
—	—		Staining
5	4–5		Washing — Alteration
5	5		Staining
Dischargeable to white	Good		**OTHER PROPERTIES** Dischargeability
—	—		Effect of Metals — Copper
—	—		Iron
—	—		Reactions in Substance
—	—		H_2SO_4 conc.
—	—		Dilute HCl
			Dilute NaOH
			NON-TEXTILE USAGE
	*Fastness on nylon (ISO): light, 6 Suitable for printing on C.I. Azoic Coupling Component 5		**NOTES**

C.I. Reactive Yellow	20	21			22
CHEMICAL CLASS	Azo	Azo			Monoazo (pyrazolone)
REACTIVE SYSTEM	—	—			—
C.I. CONSTITUTION NO.	—	—			—
HUE					
Daylight	Yellow	Bright Yellow			Bright Yellow
Artificial light (tungsten)	—	Redder			—
DYEING					
Cellulose	Pad-steam or pad-batch	—			Suitable for these fibres
Nylon	—	Acetic acid; levelling agent for pale dyeings. Levelling: moderate–good			
Silk	—	Ammonia + calcium chloride. Levelling: moderate–good			
Wool	—	Acetic acid + Glauber's salt. Levelling: moderate			
PRINTING	Cellulose: alkaline paste with alginate or emulsion thickening; steamed or baked				
FASTNESS PROPERTIES					
Fibre	Cotton	Nylon	Silk	Wool	Cotton
Method	ISO	ISO	ISO	ISO	ISO
Alkali	—	5	—	5	4 (redder, duller)
Burnt Gas Fumes	—	—	—	—	—
Carbonising — Alkaline rinse	—	—	—	5	—
Neutral rinse	—	—	—	5	—
Decatising	—	—	—	4–5*	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	6	6	4–5	4–5	—
normal	6–7	6–7	5–6	6	6*
2× normal	7	—	—	7	—
Peroxide Bleach — Alteration	4–5	—	—	4–5	—
Staining	5	—	—	5	—
Perspiration — Alteration	—	5	5	5	5
Staining	—	5	5	4–5	5
Soda Boil — Alteration	—	—	—	—	—
Staining	—	—	—	—	—
Washing — Alteration	5	4–5 (90°)C	5 (60°C)	5 (60°C)	4–5 (95°C)
Staining	5	5	—	5	5
OTHER PROPERTIES					
Dischargeability	(Alkaline) very good	Unexposed: good†			Good (wool)
Effect of Metals — Copper	—	2–3 (wool), 3 (nylon)			—
Iron	—	4–5 (wool), 3–4 (nylon)			—
Reactions in Substance					
H_2SO_4 conc.	Greenish yellow	—			—
Dilute HCl	—	—			—
Dilute NaOH	—	—			—
NON-TEXTILE USAGE					
NOTES	Suitable for use with crease-resist finishes	Good coverage of uneven nylon Suitable for shading; does not cause catalytic fading Suitable for crease-resist finishes Solubility in water 50 g/l at 50°C *2·5 kg/cm³ †Exposed: wool 4, nylon 3–4			*Fastness on silk: light 5–6; washing (60°C), 5, 5 Fastness on nylon and wool: light, 6 Solubility in water: 40 g/l Suitable for crease-resist finishes (reduced light fastness)

23	24	25	C.I. Reactive Yellow
Monoazo	Monoazo	Monoazo	**CHEMICAL CLASS**
—	—	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Bright Yellow	Dull Yellowish Orange	Bright Yellow	**HUE** Daylight
—	—	—	Artificial light (tungsten)
Suitable	Pad-batch	Padded with Na_2CO_3; fixed by batching, baking or steaming	**DYEING** Cellulose
—	—	—	Nylon
—	—	—	Silk
—	—	—	Wool
			PRINTING
Cotton ISO	Mercerised cotton ISO	Cotton ISO	**FASTNESS PROPERTIES** Fibre Method
2–3 (redder)	—	2	Alkali
—	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
4	—	6	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
4	7–8	7	normal
5	—	—	2× normal
—	—	3–4	Peroxide Bleach — Alteration
—	—	5	Staining
4–5	4–5 (acid)	5	Perspiration — Alteration
5	5	5	Staining
—	—	3	Soda Boil — Alteration
—	—	5	Staining
5	4–5 (95°C)	5	Washing — Alteration
5	5	5	Staining
For white and coloured discharges			**OTHER PROPERTIES** Dischargeability
—			Effect of Metals — Copper
—			Iron
—			Reactions in Substance
—			H_2SO_4 conc.
—			Dilute HCl
—			Dilute NaOH
			NON-TEXTILE USAGE
Suitable as a component of mixtures for green hues	Suitable for crease-resist finishes	Suitable for crease-resist finishes (redder; adverse effect on light fastness)	**NOTES**

C.I. Reactive Yellow	26	27	28
CHEMICAL CLASS	Monoazo	Monoazo	Monoazo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Reddish Yellow	Reddish Yellow	Bright Yellow
Artificial light (tungsten)	—	—	Redder
DYEING			
Cellulose	Pad-roll, pad-jig, pad-steam, pad-thermofix; fixation with soda ash	Exhaustion, pad-batch, pad-jig, pad-bake or pad-steam	Neutral salt bath, followed by alkali; or pad-batch
Nylon	—	—	—
Silk	—	—	—
Wool	—	—	—
PRINTING			Direct: $NaHCO_3$ + alginate thickening
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	4–5	3–4 (greener)	—
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	6–7	5	4–5
normal	6–7	6	5
2× normal	—	—	5–6
Peroxide Bleach — Alteration	3–4	2–3	—
Staining	4–5	4	—
Perspiration — Alteration	5	5	5 (alk)
Staining	5	5	5
Soda Boil — Alteration	2–3 (redder)	3	—
Staining	4	3–4	—
Washing — Alteration	5 (60°C)	5 (60°C)	4–5 (weaker) (60°C)
Staining	5	5	5
OTHER PROPERTIES			
Dischargeability			—
Effect of Metals — Copper			—
Iron			—
Reactions in Substance			
H_2SO_4 conc.			Greenish yellow
Dilute HCl			—
Dilute NaOH			—
NON-TEXTILE USAGE			
NOTES	Suitable for crease-resist finishes (redder; light fastness slightly lower)	Suitable for crease-resist finishes (redder; adverse effect on light fastness)	

29	30	31	C.I. Reactive Yellow
Azo	Azo	Pyrazolone	**CHEMICAL CLASS**
—	—	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Reddish Yellow	Bright Yellow	Yellow	**HUE** Daylight
Redder	—	Redder	Artificial light (tungsten)
Exhaustion dyeing of yarn and fabric	Alkaline pad liquor containing urea; one-bath pad-steam or heat fixation*	—	**DYEING** Cellulose
—	—	Neutral: acid added as dyeing proceeds	Nylon
—	—	—	Silk
—	—	Neutral, becoming faintly acid as dyeing proceeds. Levelling: good	Wool
	Cellulose: alkaline paste containing urea and special assistant, thickened with alginate; dried and fixed with neutral steam	Nylon: weakly acid; fixed by steaming Silk and wool: weakly alkaline; fixed by steaming	**PRINTING**
Cotton ISO	Cotton ISO	Wool ISO / Nylon ISO	**FASTNESS PROPERTIES** Fibre / Method
2–3 (redder)	—	— / 5	Alkali
—	—	— / —	Burnt Gas Fumes
—	—	4–5 (H_2SO_4) / 5 ($AlCl_3$)	Carbonising — Alkaline rinse
—	—	4–5 / 5	Neutral rinse
—	—	4–5, 5 (severe) / 5 (severe)	Decatising
5–6	5–6	6 / 6–7	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
6	6–7	6–7 / 7	normal
—	—	7 / 7	2× normal
—	4–5	2–3 / —	Peroxide Bleach — Alteration
—	4–5	4–5 / —	Staining
4	4–5	5 / 4–5	Perspiration — Alteration
5	4–5	4–5 / 4	Staining
4	—	— / —	Soda Boil — Alteration
3–4	—	— / —	Staining
4–5 (95°C)	4–5	4 (60°C) / 5 (60°C)	Washing — Alteration
4	4–5	5 / 5	Staining
Good	—	Not dischargeable	**OTHER PROPERTIES** Dischargeability
—	—	3–4 (duller)	Effect of Metals — Copper
—	—	1 (duller)	Iron
—	Yellow; greener on dilution	—	Reactions in Substance H_2SO_4 conc.
—	—	—	Dilute HCl
—	Weaker: almost decolorised	—	Dilute NaOH
			NON-TEXTILE USAGE
Suitable for crease-resist finishes (yellower), rubberising and PVC coating	Suitable for crease-resist finishes *This dye does not react directly with the fibre, but requires the use of a fixing agent	Solubility in water 60 g/l Unaffected by hard water Acetate, cellulose and silk stained; acrylic and polyester unstained	**NOTES**

C.I. Reactive Yellow	32			33
CHEMICAL CLASS	Monoazo			Azo
REACTIVE SYSTEM	—			Dichloropyridazonyl
C.I. CONSTITUTION NO.	—			—
HUE				
Daylight	Greenish Yellow			Reddish Yellow
Artificial light (tungsten)	Somewhat redder			—
DYEING				
Cellulose	—			Padded with alkali; fixed by steaming, thermofix, batching or pad-roll process
Nylon	Acetic acid + levelling agent			—
Silk	—			—
Wool	Na_2SO_4 at 40–50°C→boil; ammonium acetate added			—
PRINTING	Nylon: thermofix process Direct printing on unweighted silk			Cellulose
FASTNESS PROPERTIES				
Fibre	Wool	Nylon 6.6	Nylon 6	Cotton
Method	ISO	ISO	ISO	ISO
Alkali	4	4	4–5	—
Burnt Gas Fumes	—	—	—	—
Carbonising — Alkaline rinse	3	3	4	—
Neutral rinse	—	—	—	—
Decatising	4	4	4	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	4–5	4–5	3	4–5
normal	5–6	5	4–5	5–6
2× normal	6	6	5	—
Peroxide Bleach — Alteration	—	—	—	—
Staining	—	—	—	—
Perspiration — Alteration	5	4–5	5	5 (acid)
Staining	5	5, 4–5 (acid, alk)	5	5
Soda Boil — Alteration	—	—	—	—
Staining	—	—	—	—
Washing — Alteration	5	3 (60°C)	4–5	4
Staining	4–5	5	5	5
OTHER PROPERTIES				
Dischargeability	To white on wool; to light shades on nylon 6			—
Effect of Metals — Copper	Slightly duller			—
Iron	Redder and duller			—
Reactions in Substance				
H_2SO_4 conc.	—			Gold yellow
Dilute HCl	—			—
Dilute NaOH	—			No change
NON-TEXTILE USAGE				
NOTES	Solubility in water: very good Suitable for dyeing wool unions			

34	35	36	C.I. Reactive Yellow
Azo (metallised)	Azo	Azo	**CHEMICAL CLASS**
—	Monochlorotriazinyl	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Reddish Yellow	Greenish Yellow	Yellow	**HUE** Daylight
Much redder	Redder	Redder	Artificial light (tungsten)
—	Batchwise processes	Dyed	**DYEING** Cellulose
—	Slightly stained	—	Nylon
—	—	—	Silk
Ammonium acetate (or sulphate) + acetic acid	Unsuitable	Weakly acid	Wool
	Cellulose: unsuitable	Cellulose: direct, with $NaHCO_3$; fixed by steaming	**PRINTING**
Wool ISO	Cellulose ISO	Cellulose ISO	**FASTNESS PROPERTIES** Fibre Method
— — 4–5 (redder) 4–5 (redder) 5 (severe)	4 (redder) — — — —	3–4 — — — —	Alkali Burnt Gas Fumes Carbonising — Alkaline rinse Neutral rinse Decatising
— 7 7	4–5 5–6 6	5 6 —	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal
4–5 (redder) 5 5 5	3–4 (redder) — 5 (acid) 5	4 — — —	Peroxide Bleach — Alteration Staining Perspiration — Alteration Staining
— — 4–5 (ISO 3) 5	3–4 (bluer, weaker) 4 4–5 5	— — 4–5 (60°C) —	Soda Boil — Alteration Staining Washing — Alteration Staining
— 3–4 (greener, duller) 4–5 (duller)	Neutral very good; alkaline good 3–4 (duller) 4–5	Neutral very good; alkaline good Slightly redder Slightly redder and duller	**OTHER PROPERTIES** Dischargeability Effect of Metals — Copper Iron
— — —	Greenish yellow Greenish yellow Greenish yellow	Yellow Unchanged Unchanged	Reactions in Substance H_2SO_4 conc. Dilute HCl Dilute NaOH
Clothing leathers			**NON-TEXTILE USAGE**
Solubility in water: 120 g/l at 90°C Effect threads: acetate 4–5, cotton 4, nylon 1, polyester 4–5, silk 2, viscose 4	Acetate and cellulose heavily stained; triacetate slightly stained Good coverage of dead cotton and barré viscose Solubility in water 180–200 g/l Suitable for goods to be rubberised or coated with PVC	Solubility in water: very good	**NOTES**

C.I. Reactive Yellow	37	38	39
CHEMICAL CLASS	Monoazo	Azo	Azo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Yellow	Reddish Yellow	Greenish Yellow
Artificial light (tungsten)	—	Redder	Redder
DYEING			
Cellulose	Padded with $NaHCO_3$ and urea; fixed by steaming or dry heat	4 (a, b), 5 (a, b), 6 (a, b, c)	—
Nylon	—	—	—
Silk	—	—	—
Wool	—	—	Exhaustion dyeing
PRINTING	Cellulose: with $NaHCO_3$ and a neutral alginate thickener; fixed by neutral steaming Also discharge styles	Cellulose: direct; fixation by steam or dry heat flash ageing Silk, unions	Silk and wool
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Wool
Method	ISO	ISO	ISO
Alkali	4 (redder)	2–3 (greener)	—
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	5–6	4	5–6
normal	6	4–5	6
2× normal	6–7	5	6–7
Peroxide Bleach — Alteration	—	4 (greener)	—
Staining	—	5	—
Perspiration — Alteration	4–5	—	—
Staining	4–5	—	—
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	3–4 (95°C)	5	4 (redder)
Staining	5	5	5
OTHER PROPERTIES			
Dischargeability	Good	Good	Very good
Effect of Metals — Copper	—	—	4 (redder)
Iron	—	—	5
Reactions in Substance			
H_2SO_4 conc.	—	Greenish yellow	Greenish yellow
Dilute HCl	—	Greenish yellow	Greenish yellow
Dilute NaOH	—	Greenish yellow	Greenish yellow
NON-TEXTILE USAGE			
NOTES	Suitable for goods to be coated with PVC		Solubility in water: very good Good wet fastness on chlorinated wool

40	41	42	C.I. Reactive Yellow
Monoazo	Monoazo	Monoazo (pyrazolone)	CHEMICAL CLASS
—	—	—	REACTIVE SYSTEM
—	—	—	C.I. CONSTITUTION NO.
Yellow	Reddish Yellow	Reddish Yellow	HUE Daylight
Redder	Somewhat redder	Slightly redder	Artificial light (tungsten)
Pad-fix processes, or applied from a hot neutral salt or Na_2SO_4 bath; fixed with strong alkali Acid bath	Exhaustion dyeing (winch or jig) —	Winch or pad dyeing (two-bath pad-steam process) —	DYEING Cellulose Nylon
Dyed with salt + Na_3PO_4	—	—	Silk
Acid + cationic assistant	—	—	Wool
Cellulose: direct, with soda ash, urea, a reduction inhibitor and alginate or emulsion thickening; fixed by steaming		Cotton and viscose	PRINTING
Cotton ISO	Cellulose ISO	Cotton ISO	FASTNESS PROPERTIES Fibre Method
— — — — —	2 — — — —	3 (redder) — — — —	Alkali Burnt Gas Fumes Carbonising — Alkaline rinse Neutral rinse Decatising
6 6–7 —	4 4–5 —	— — —	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal
4–5 5 — —	— — 5 5	— — 4 alk, 5 acid 5, 5	Peroxide Bleach — Alteration Staining Perspiration — Alteration Staining
— — 4–5 5	— — 5 (5 × 95°C) 5	— — 4–5 (× 1), 4 (× 5) (95°C) 5	Soda Boil — Alteration Staining Washing — Alteration Staining
Very good Unaffected Unaffected Brown Redder Redder	3–4 (neutral or alk) — — — — —	Dischargeable to white — — — — —	OTHER PROPERTIES Dischargeability Effect of Metals — Copper Iron Reactions in Substance H_2SO_4 conc. Dilute HCl Dilute NaOH
			NON-TEXTILE USAGE
	Solubility in water at 30°C: 30 g/l Good stability to hard water. Good coverage of dead cotton and barré viscose Crease-resist finishes: trace greener; light fastness unchanged	Suitable for PVC coating	NOTES

C.I. Reactive Yellow	43	44	45
CHEMICAL CLASS	Azo	Azo	Azo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Bright Greenish Yellow	Bright Reddish Yellow	Bright Greenish Yellow
Artificial light (tungsten)	—	—	—
DYEING			
Cellulose	1 (a, b, c), 2 (a, b), 3 (a, b, c)	Padding, dyebath and continuous methods (as for C.I. Reactive Yellow 1)	Padding, dyebath and continuous methods (as for C.I. Reactive Yellow 2)
Nylon	Suitable	Suitable	Suitable
Silk	Suitable	Suitable	Suitable
Wool	Suitable	Suitable	Suitable
PRINTING	Cellulose, nylon, silk and wool: direct processes	Direct printing on cellulose, nylon, silk and wool	Direct on cellulose, nylon, silk and wool
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	—	—	—
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	—	—
normal	5–6	6	4–5
2× normal	—	—	—
Peroxide Bleach — Alteration	—	—	—
Staining	—	—	—
Perspiration — Alteration	3–4	4–5	4–5
Staining	—	—	—
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	2 (5×95°C)	4–5 (5×95°C)	3 (5×95°C)
Staining	—	—	—
OTHER PROPERTIES			
Dischargeability	Good	Moderate	Good
Effect of Metals — Copper	—	—	—
Iron	—	—	—
Reactions in Substance			
H_2SO_4 conc.	—	—	—
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE			
NOTES	Solubility in water: very good	Solubility in water: good	Solubility in water: very good

46	47	48	C.I. Reactive Yellow
Azo	Monoazo	Azo	**CHEMICAL CLASS**
—	—	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Bright Reddish Yellow	Bright Greenish Yellow	Yellow	**HUE** Daylight
—	Redder	Redder	Artificial light (tungsten)
Padding, dyebath and continuous methods	—	Not recommended	**DYEING** Cellulose
Suitable	—		Nylon
	—		Silk
	pH 6, 70°C, liquor ratio 35:1		Wool
Direct on cellulose, nylon, silk and wool		Cotton: two-phase printing process or rapid steaming process (hot air development is not recommended)	**PRINTING**
Cotton ISO	Wool ISO	Cotton ISO	**FASTNESS PROPERTIES** Fibre Method
—	—	—	Alkali
—	—	—	Burnt Gas Fumes
—	4–5 (redder)	—	Carbonising — Alkaline rinse
—	4–5 (redder)	—	Neutral rinse
—	5	—	Decatising
—	5	5	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
4–5	6	6	normal
—	6–7	—	2× normal
—	2 (redder)	4	Peroxide Bleach — Alteration
—	5	5	Staining
4–5	5	4–5	Perspiration — Alteration
—	4–5	4–5	Staining
—	—	—	Soda Boil — Alteration
—	—	—	Staining
3–4 (5×95°C)	4–5 (ISO 3)	4 (test 4)	Washing — Alteration
—	5	5	Staining
Moderate	—	—	**OTHER PROPERTIES** Dischargeability
—	3 (redder, duller)	—	Effect of Metals — Copper
—	4–5 (redder)*	—	Iron
—	—	—	Reactions in Substance H_2SO_4 conc.
—	—	—	Dilute HCl
—	—	—	Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: good	*Effect of chromium 2 (redder)	Solubility: 95 g/kg paste Print paste is stable for 3 weeks Unsuitable for overprinting with caustic alkali Suitable for PVC coating	**NOTES**

C.I. Reactive Yellow	49	50	51
CHEMICAL CLASS	Monoazo	Monoazo	Monoazo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Greenish Yellow	Reddish Yellow	Yellow
Artificial light (tungsten)	—	—	Lighter, redder
DYEING			
Cellulose	Pad-cure or one-bath pad-steam process	Pad-cure or one-bath pad-steam process	
Nylon	—	—	
Silk	—	—	
Wool	—	—	
PRINTING	Cellulose: printed with urea and $NaHCO_3$; fixed by neutral steam, dry heat, flash-age or cold alkali pad-batch process Also discharge processes	Direct or discharge processes Fixed by neutral steaming	Cellulose: steaming, high-temperature steaming, flash-age and wet development processes. Build-up very good; washing off rapid and reliable Resist styles*
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	—	5	3 (redder, duller)
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	5	6	—
normal	5–6	6	6
2× normal	6	6–7	6
Peroxide Bleach — Alteration	3–4	3–4 (redder)	—
Staining	5	5	—
Perspiration — Alteration	5	5	5
Staining	5	5	5
Soda Boil — Alteration	4–5	4	—
Staining	5	5	—
Washing — Alteration	4–5 (×5 at boil)	5 (×1 at boil)*	5 (ISO 4)
Staining	5	5	5
OTHER PROPERTIES			
Dischargeability	Good (neutral or alkaline)	Good (neutral and alkaline)	Good
Effect of Metals — Copper	—	—	—
Iron	—	—	—
Reactions in Substance			
H_2SO_4 conc.	—	—	—
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE			
NOTES	Suitable for PVC coating	Solubility in water: 100 g/l at 77°F Suitable for PVC coating *Fastness to washing (×5 at boil) 4 (staining 5)	*May be printed on chlorinated wool, silk and polyester/cotton unions, but unsuitable for polyamides Suitable for use with C.I. Azoic Coupling Components

52	53	54	C.I. Reactive Yellow
Azo	Azo	Azo	**CHEMICAL CLASS**
—	—	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Bright Greenish Yellow	Reddish Yellow	Reddish Yellow	**HUE** Daylight
—	Slightly redder	Redder	Artificial light (tungsten)
Pad-cure or one-bath pad-steaming	Cellulose: padding	Pad-thermofix or one-bath pad steam process	**DYEING** Cellulose
—	—	—	Nylon
—	—	—	Silk
—	—	—	Wool
Neutral steaming	Cellulose: direct and discharge styles	Cellulose: neutral steam fixation	**PRINTING**
Cotton ISO	Cellulose and wool ISO	Cotton ISO	**FASTNESS PROPERTIES** Fibre Method
3 (redder)	—	4	Alkali
—	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
5	—	5	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
5	6	6	normal
—	—	—	2× normal
3–4	3–4	3	Peroxide Bleach — Alteration
5	4–5 (cotton)	5	Staining
5	4–5	5	Perspiration — Alteration
5	4–5 (cotton), 5 (wool)	5	Staining
—	—	3	Soda Boil — Alteration
—	—	5	Staining
5 (95°C)*	4–5 (test 4)	5 (95°C)*	Washing — Alteration
5	4–5 (cotton)	5	Staining
White (neutral and alkaline)	To white	Good	**OTHER PROPERTIES** Dischargeability
—	—	—	Effect of Metals — Copper
—	—	—	Iron
—	—	—	Reactions in Substance
—	—	—	H_2SO_4 conc.
—	—	—	Dilute HCl
—	—	—	Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: 40 g/l Print paste is stable for more than 28 days at 20°C Suitable for over-printing with caustic alkali *Fastness to washing (once at boil) 4–5	Print paste is stable over 4 weeks	Solubility in water: >100 g/l at 25°C Print paste has good stability at 20°C Suitable for crease-resist finishes, but there is a slight change in hue and a loss of light fastness *Fastness to washing at 100°C 4–5, 5	**NOTES**

C.I. Reactive Yellow	55	56	57
CHEMICAL CLASS	Monoazo	Monoazo	Monoazo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Bright Greenish Yellow	Bright Reddish Yellow	Greenish Yellow
Artificial light (tungsten)	—	—	Redder
DYEING			
Cellulose	Suitable	Suitable	Exhaustion dyeing on winch or jigger; pad-fix processes
Nylon	—	—	—
Silk	—	—	—
Wool	—	—	—
PRINTING	Cellulose: mainly for printing by one- or two-stage processes Suitable for printing on chlorinated wool and union fabrics	Cellulose: mainly for printing by one- or two-stage fixation processes Suitable for printing on chlorinated wool and union fibres	
FASTNESS PROPERTIES			
Fibre	Cellulose	Cellulose	Cotton
Method	ISO	ISO	ISO
Alkali	3–4 (redder)	3–4	3–4 (redder)
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	6	4–5	5
normal	6–7	5	6–7
2× normal	—	—	—
Peroxide Bleach — Alteration	4	4	—
Staining	—	—	—
Perspiration — Alteration	—	—	5
Staining	—	—	5
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	5 (ISO 4)	4–5 (ISO 4)	4–5 (95°C)
Staining	5	—	4
OTHER PROPERTIES			
Dischargeability	Good (neutral)	Very good (neutral)	Good
Effect of Metals — Copper	—	—	—
Iron	—	—	—
Reactions in Substance			
H_2SO_4 conc.	—	—	—
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE			
NOTES	Solubility in water: very good Suitable for use with crease-resist finishes	Solubility in water: very good Suitable for use with crease-resist finishes	Solubility in water: 200 g/l at 100°C Affinity for cellulose: Group III Stability of pad liquor containing 20 g/l dye at 20°C: 24 h with $NaHCO_3$, 4 h with Na_2CO_3, $\frac{3}{4}$ h with NaOH Nylon stained, acetate slightly stained, triacetate very slightly stained, polyester and acrylic unstained Suitable for crease-resist finishes (some hue change, light fastness reduced by $\frac{1}{2}$–1 point)

58	59	60	C.I. Reactive Yellow
Azo	Monoazo	Monoazo	**CHEMICAL CLASS**
—	—	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Yellow	Yellow	Yellow	**HUE** Daylight
—	Redder	Brighter	Artificial light (tungsten)
Exhaustion dyeing (Na_2SO_4 or NaCl + Na_2CO_3 or Na_3PO_4)		Pad dyeing; fixed by acid catalyst and dry heat	**DYEING** Cellulose
—		—	Nylon
—		—	Silk
—		—	Wool
	Pad-steam, pad-(alkali shock)	Cellulose: fixed by acid catalyst and dry heat	**PRINTING**
Cotton ISO	Cotton ISO	Cotton AATCC	**FASTNESS PROPERTIES** Fibre Method
—	4	—	Alkali
—	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
5–6	5–6	—	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
6	6	—	normal
—	—	—	2× normal
5	—	—	Peroxide Bleach — Alteration
5	—	—	Staining
5	4	4–5	Perspiration — Alteration
5	5	—	Staining
—	—	—	Soda Boil — Alteration
—	—	—	Staining
5 (test 4)	3 (redder, duller) (95°C)	4–5	Washing — Alteration
5	5	—	Staining
	2–3 (neutral), 1–2 redder (alk)		**OTHER PROPERTIES** Dischargeability
	—		Effect of Metals — Copper
	—		Iron
	—		Reactions in Substance
	—		H_2SO_4 conc.
	—		Dilute HCl
	—		Dilute NaOH
			NON-TEXTILE USAGE
Suitable for cotton and viscose staple fibre	Solubility in water 200 g/l Withstands hydrosulphite well, but almost stripped by sodium hypochlorite	Literature: *BP* 1,100,599 McCleary, Cate, Fordemwalt and Loffelman, *Am. Dyestuff Rep.*, 1967, **56**, P46–51	**NOTES**

C.I. Reactive Yellow	61	62	63
CHEMICAL CLASS	Monoazo	Monoazo	Azo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Yellow	Yellow	Yellow
Artificial light (tungsten)	Brighter	Brighter	Redder
DYEING			
Cellulose	Pad-dyeing; fixed by acid catalyst and dry heat	Pad-dyeing; fixed by acid catalyst and dry heat	Thermofixation and one-bath pad-steam processes
Nylon	—	—	—
Silk	—	—	—
Wool	—	—	—
PRINTING	Cellulose: fixed by acid catalyst and dry heat	Cellulose: fixed by acid catalyst and dry heat	Cellulose: neutral steam processes
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	AATCC	AATCC	ISO
Alkali	—	—	3–4
Burnt Gas Fumes	—	—	
Carbonising — Alkaline rinse	—	—	
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	—	4
normal	—	—	4–5
2× normal	—	—	5
Peroxide Bleach — Alteration	—	—	3–4
Staining	—	—	5
Perspiration — Alteration	4–5	4–5	5
Staining	—	—	5
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	3	4	5 (95°C)
Staining	—	—	5
OTHER PROPERTIES			
Dischargeability			
Effect of Metals — Copper			
Iron			
Reactions in Substance			
H_2SO_4 conc.			
Dilute HCl			
Dilute NaOH			
NON-TEXTILE USAGE			
NOTES	Literature: *BP* 1,100,599 McCleary, Cate, Fordemwalt and Loffelman, *Am Dyestuff Rep.*, 1967, **56**, P46–51	Literature: *BP* 1,100,599 McCleary, Cate, Fordemwalt and Loffelman, *Am Dyestuff Rep.*, 1967, **56**, P46–51	Solubility in water at 25°C: 100 g/l Print paste is stable for more than 28 days. Suitable for overprinting with caustic alkali and for PVC coating

64	65	66	C.I. Reactive Yellow
Disazo	Monoazo	Monoazo	CHEMICAL CLASS
—	Dichlorophthalazinecarbonyl	Dichlorophthalazinecarbonyl	REACTIVE SYSTEM
—	—	—	C.I. CONSTITUTION NO.
Yellow	Yellow	Yellow	HUE Daylight
Somewhat redder	Little or no change	Redder	Artificial light (tungsten)
	Pad-thermofix, pad-batch, pad-steam, pad-roll, pad-jig or exhaustion processes	As for C.I. Reactive Yellow 65	DYEING Cellulose
	—	—	Nylon
	—	—	Silk
	—	—	Wool
	Not recommended	Cellulose: direct printing with fixation by steaming, thermofixation, flash-ageing or treatment with alkali (cold or hot)	PRINTING
Cotton ISO	Cotton ISO	Cotton ISO	FASTNESS PROPERTIES Fibre Method
3 (redder)	3 (redder)	2 (redder)	Alkali
—	5	5	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
5	—	5	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
6	5–6	6	normal
—	6–7	—	2× normal
3 (redder, weaker) (wash)	4 (redder)	4 (redder)	Peroxide Bleach — Alteration
4–5	5	5	Staining
5 (acid and alk)	5	5	Perspiration — Alteration
5	5	5	Staining
—	—	—	Soda Boil — Alteration
—	—	—	Staining
4 (Test 4)	4 (No.4, 95°C)	4–5 (No.4, 95°C)	Washing — Alteration
4	5	5	Staining
Neutral 5; alkaline 4–5	5 (neutral or alkaline)	5 (neutral), 4 (alkaline)	OTHER PROPERTIES Dischargeability
—	—	—	Effect of Metals — Copper
—	—	—	Iron
—	—	—	Reactions in Substance H_2SO_4 conc.
—	—	—	Dilute HCl
—	—	—	Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: 40, 50 g/l at 40° and 90°C respectively; stable to hard water PVC coating: suitable Crease-resist finishes: shade affected; light fastness may be enhanced slightly or reduced	Solubility in water: 5, 12, 25 g/l at 30°, 60° and 90°C respectively	Solubility in water: 200 g/l	NOTES

C.I. Reactive Yellow 67—72

C.I. Reactive Yellow	67	68	69
CHEMICAL CLASS	Monoazo	Monoazo	Azo
REACTIVE SYSTEM	Dichlorophthalazinecarbonyl	Dichlorophthalazinecarbonyl	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Yellow	Reddish Yellow	Yellow
Artificial light (tungsten)	Little or no change	Little or no change	Somewhat redder
DYEING			
Cellulose	As for C.I. Reactive Yellow 65	As for C.I. Reactive Yellow 65	Very slightly stained
Nylon	—	—	Dyed
Silk	—	—	Heavily stained
Wool	—	—	pH 4·5–5; acetic acid + Na_2SO_4 + auxiliary*
PRINTING	As for C.I. Reactive Yellow 66	Not recommended (because of low solubility)	
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Wool
Method	ISO	ISO	ISO
Alkali	3 (redder)	4–5	4
Burnt Gas Fumes	5	5	—
Carbonising — Alkaline rinse	—	—	5
Neutral rinse	—	—	5
Decatising	—	—	4–5
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	5–6	5	5
normal	6–7	6	5–6
2× normal	—	—	6
Peroxide Bleach — Alteration	3 (redder)	4 (redder)	4–5
Staining	5	5	5
Perspiration — Alteration	5	5	5
Staining	5	5	5
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	4–5 (No.4, 95°C)	4–5 (No.4, 95°C)	4 (5 × 60°C)
Staining	5	5	4–5
OTHER PROPERTIES			
Dischargeability	5 (neutral or alkaline)	4 (neutral or alkaline)	4–5
Effect of Metals — Copper	—	—	3–4
Iron	—	—	3–4
Reactions in Substance			
H_2SO_4 conc.	—		
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
		—	—
NON-TEXTILE USAGE			
NOTES	Solubility in water: 100, 125, 150 g/l at 30°, 60° and 90°C respectively	Solubility in water: 10, 12, 25 g/l at 30°, 60° and 90°C respectively	Solubility in water: 91–100 g/l at 90°C *May be aftertreated with ammonia for deep dyeings on wool or chlorinated wool

70	71	72	C.I. Reactive Yellow
Azo	Azo	Monoazo	**CHEMICAL CLASS**
—	—	Vinylsulphonyl	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Reddish Yellow	Bright Reddish Yellow	Bright Greenish Yellow	**HUE** Daylight
Redder	—	—	Artificial light (tungsten)
Stained	4 (a, b), 5 (a, b), 6 (a, b, c)	1 (a, b, c), 2 (a, b), 3 (a, b, c)	**DYEING** Cellulose
Dyed	Suitable	—	Nylon
Heavily stained	Suitable	—	Silk
pH 4·5–5; acetic acid + Na_2SO_4 + auxiliary*	Suitable	—	Wool
	Cellulose, nylon, silk and wool: as for C.I. Reactive Yellow 2	Cellulose: printed with $NaHCO_3$, urea and a neutral alginate thickener; fixed by neutral steam or dry heat	**PRINTING**
Wool ISO	Cellulose ISO	Cotton ISO	**FASTNESS PROPERTIES** Fibre Method
4	—	—	Alkali
—	—	—	Burnt Gas Fumes
4–5	—	—	Carbonising — Alkaline rinse
4–5	—	—	Neutral rinse
4–5	—	—	Decatising
4	—	—	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
5	6	6	normal
5–6	—	—	2× normal
4–5	—	—	Peroxide Bleach — Alteration
5	—	—	Staining
4–5	4–5	5	Perspiration — Alteration
5	—	5	Staining
—	—	—	Soda Boil — Alteration
—	—	—	Staining
4 (5×60°C)	4–5 (5×95°C)	5 (95°C)	Washing — Alteration
4–5	—	5	Staining
3–4	Very good		**OTHER PROPERTIES** Dischargeability
3–4	—		Effect of Metals — Copper
4	—		Iron
—	—		Reactions in Substance H_2SO_4 conc.
—	—		Dilute HCl
—	—		Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: 61–70 g/l *May be aftertreated with ammonia for deep dyeings on wool or chlorinated wool	Solubility in water: good		**NOTES**

C.I. Reactive Yellow	73	74	75
CHEMICAL CLASS	Monoazo	Monoazo	Monoazo
REACTIVE SYSTEM	Vinylsulphonyl	Vinylsulphonyl	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Yellow	Reddish Yellow	Yellow
Artificial light (tungsten)	—	—	—
DYEING			
Cellulose	1 (a, b, c), 2 (a, b), 3 (a, b, c)	1 (a, b, c), 2 (a, b), 3 (a, b, c)	Padded cold with urea + $NaHCO_3$; fixed by steam or dry heat
Nylon	—	—	—
Silk	—	—	—
Wool	—	—	—
PRINTING	Cellulose: printed with $NaHCO_3$, urea and a neutral alginate thickener; fixed by neutral steam or dry heat	Cellulose: printed with $NaHCO_3$, urea and a neutral alginate thickener; fixed by neutral steam or dry heat	Cellulose: direct processes, print paste containing $NaHCO_3$ and a neutral alginate thickener; fixation by neutral steam
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	—	—	3
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	—	—
normal	5	6	4–5
2× normal	—	—	—
Peroxide Bleach — Alteration	—	—	—
Staining	—	—	—
Perspiration — Alteration	5	3–4	5
Staining	5	5	5
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	5 (95°C)	3 (95°C)	5 (70°C)
Staining	5	5	5
OTHER PROPERTIES			
Dischargeability			Dischargeable to white
Effect of Metals — Copper			—
Iron			—
Reactions in Substance			
H_2SO_4 conc.			—
Dilute HCl			—
Dilute NaOH			—
NON-TEXTILE USAGE			
NOTES			Solubility in water: good

76	77	C.I. Reactive Yellow
Monoazo	Monoazo	**CHEMICAL CLASS**
—	—	**REACTIVE SYSTEM**
—	—	**C.I. CONSTITUTION NO.**
Reddish Yellow	Reddish Yellow	**HUE** Daylight
—	—	Artificial light (tungsten)
Padded cold with urea + $NaHCO_3$; fixed by steam or dry heat	Padded cold with urea + $NaHCO_3$; fixed by steam or dry heat	**DYEING** Cellulose
—	—	Nylon
—	—	Silk
—	—	Wool
Cellulose: direct processes, print paste containing $NaHCO_3$ and a neutral alginate thickener; fixation by neutral steam	Cellulose: direct processes, print paste containing $NaHCO_3$ and a neutral alginate thickener; fixation by neutral steam	**PRINTING**
Cotton ISO	Cotton ISO	**FASTNESS PROPERTIES** Fibre Method
4	4–5	Alkali
—	—	Burnt Gas Fumes
—	—	Carbonising — Alkaline rinse
—	—	Neutral rinse
—	—	Decatising
—	—	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
5	5	normal
—	—	2× normal
—	—	Peroxide Bleach — Alteration
—	—	Staining
5	5	Perspiration — Alteration
5	5	Staining
—	—	Soda Boil — Alteration
—	—	Staining
5 (70°C)	5 (70°C)	Washing — Alteration
5	5	Staining
Dischargeable to white	Dischargeable to white	**OTHER PROPERTIES** Dischargeability
—	—	Effect of Metals — Copper
—	—	Iron
—	—	Reactions in Substance H_2SO_4 conc.
—	—	Dilute HCl
—	—	Dilute NaOH
		NON-TEXTILE USAGE
Solubility in water: good	Solubility in water: good	**NOTES**

C.I. Reactive Yellow	78	79
CHEMICAL CLASS	Aminoketone	Monoazo
REACTIVE SYSTEM	—	—
C.I. CONSTITUTION NO.	—	—
HUE		
Daylight	Fluorescent Yellow	Greenish Yellow
Artificial light (tungsten)	—	—
DYEING		
Cellulose	Padded cold with urea+$NaHCO_3$; fixed by steam or dry heat	Padded cold with urea+$NaHCO_3$; fixed by steam or dry heat
Nylon	—	—
Silk	—	—
Wool	—	—
PRINTING	Cellulose: direct processes, print paste containing $NaHCO_3$ and a neutral alginate thickener; fixation by neutral steam	Cellulose: direct processes, print paste containing $NaHCO_3$ and a neutral alginate thickener; fixation by neutral steam
FASTNESS PROPERTIES		
Fibre	Cotton	Cotton
Method	ISO	ISO
Alkali	4	4–5
Burnt Gas Fumes	—	—
Carbonising — Alkaline rinse	—	—
Neutral rinse	—	—
Decatising	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	—
normal	2	4–5
2× normal	—	—
Peroxide Bleach — Alteration	—	—
Staining	—	—
Perspiration — Alteration	5	5
Staining	5	5
Soda Boil — Alteration	—	—
Staining	—	—
Washing — Alteration	5 (70°C)	5 (70°C)
Staining	5	5
OTHER PROPERTIES		
Dischargeability	Not suitable for discharge	Dischargeable to white
Effect of Metals — Copper	—	—
Iron	—	—
Reactions in Substance		
H_2SO_4 conc.	—	—
Dilute HCl	—	—
Dilute NaOH	—	—
NON-TEXTILE USAGE		
NOTES	Solubility in water: good	Solubility in water: good

C.I. Reactive Orange	1	2	3
CHEMICAL CLASS	Monoazo	Monoazo	Azo
REACTIVE SYSTEM	Dichlorotriazinyl	Monochlorotriazinyl	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Bright Orange	Bright Orange	Bright Orange
Artificial light (tungsten)	Redder	Little redder	Unchanged
DYEING			
Cellulose	1 (a, b, c), 2 (a, b), 3 (a, b, c)	4 (a, b), 5 (a, b), 6 (a, b, c)	—
Nylon	As for C.I. Reactive Yellow 1	As for C.I. Reactive Yellow 1	Acetic acid; soda ash added for fixation*
Silk		As for C.I. Reactive Yellow 3	—
Wool		As for C.I. Reactive Yellow 1	—
PRINTING	As for C.I. Reactive Yellow 1 Printing on C.I. Azoic Coupling Components 2 and 5	Nylon: as for C.I. Reactive Yellow 2	Nylon: with acetic acid, sodium acetate and sodium chlorate; steamed 30 min. Acetate and triacetate: with urea and sodium chlorate; steamed 30 min

FASTNESS PROPERTIES

Fibre / Method	Cotton ISO	Nylon ISO	Silk ISO	Cotton ISO	Nylon ISO	Silk ISO	Nylon ISO	Acetate ISO	Triacetate ISO
Alkali	5	—	—	3–4 (redder)	—	—	5	—	—
Burnt Gas Fumes	—	—	—	—	—	—	—	5	5
Carbonising — Alkaline rinse	—	—	—	—	—	—	2	—	—
Neutral rinse	—	—	—	—	—	—	—	—	—
Decatising	—	—	—	—	—	—	5	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	—	—	—	—	—	—	—	—
normal	4–5	5	5	4–5	5	3–4	5	5	4
2× normal	5	6	5	5	—	4–5	5	5	4–5
Peroxide Bleach — Alteration	3	5	2	4–5 (yellower)	5	5	—	—	—
Staining	3–4	5	5	3–4	5	5	—	—	—
Perspiration — Alteration	4–5	—	—	4–5 (yellower)	—	—	5	5	5
Staining	3	—	—	5	—	—	—	3–4	4–5
Soda Boil — Alteration	—	—	—	—	—	—	—	—	—
Staining	—	—	—	—	—	—	—	—	—
Washing — Alteration	3–4*	3–4 (95°C)	5 (95°C)	3–4 (yellower)	5 (95°C)	5 (95°C)	5	5 (Test 3)	5 (Test 3)
Staining	4	5	5	4–5 (5 × 100°C)	5	5	—	5	5

OTHER PROPERTIES			
Dischargeability	White from pale dyeings only	Dischargeable to white	Very good
Effect of Metals — Copper	2 (redder, duller)	1 (redder, duller)	5
Iron	3	3–4 (yellower)	5
Reactions in Substance			
H_2SO_4 conc.	—	Red; on dilution—orange	—
Dilute HCl	—	Unaffected	—
Dilute NaOH	—	Red	—
NON-TEXTILE USAGE			
NOTES	Solubility in water: very good *(5 × 100°C)	Solubility in water: very good; not sensitive to hard water Suitable for crease-resist finishes (4–5)	*Jig, winch and package dyeing

C.I. Reactive Orange	4	5	6
CHEMICAL CLASS	Azo	Monoazo	Monoazo
REACTIVE SYSTEM	Dichlorotriazinyl	Monochlorotriazinyl	Trichloropyrimidinyl
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Bright Reddish Orange	Bright Orange	Bright Orange
Artificial light (tungsten)	Little redder	—	Slightly brighter
DYEING			
Cellulose	1(a,b,c), 2(a,b), 3(a,b,c)	4(a,b), 5(a,b), 6(a,b,c)	Continuous pad (alkali)-batch and batchwise processes
Nylon	—	—	—
Silk	—	—	Salt + Na_3PO_4 at 50→85°C
Wool	As for C.I. Reactive Yellow 1	As for C.I. Reactive Yellow 1	Acetic acid + cationic agent at 50→100°C
PRINTING	Cellulose, nylon, silk and wool: as for C.I. Reactive Yellow 1 Printing on C.I. Azoic Coupling Components 2 and 5	Cellulose, nylon, silk and wool: as for C.I. Reactive Yellow 2	Cellulose, silk and wool: as for C.I. Reactive Yellow 8
FASTNESS PROPERTIES			
Fibre	Cotton*	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	4 (yellower)	3 (redder)	—
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	4	4
normal	4	5	4–5
2× normal	4	5	—
Peroxide Bleach — Alteration	4–5	4 (yellower)	5
Staining	5	—	5
Perspiration — Alteration	4–5 (yellower)	—	5
Staining	4	—	5
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	4–5 (5×100°C)	4 (yellower)	5 (95°C)
Staining	5	—	5
OTHER PROPERTIES			
Dischargeability	Coloured discharges†	—	Suitable
Effect of Metals — Copper	1 (weaker and redder)	3 (bluer and duller)	—
Iron	Unaffected	4–5	—
Reactions in Substance			
H_2SO_4 conc.	—	—	—
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE			
NOTES	Solubility in water: excellent *Fastness on nylon: light 5 Fastness on silk: light 4–5 †From pale dyeings	Solubility in water: very good; not sensitive to hard water Suitable for use with crease-resist processes (4–5)	Solubility in water: very good Crease-resist finishes: duller and redder; light fastness unchanged

7	8	9	C.I. Reactive Orange
Monoazo	Monoazo	Azo	**CHEMICAL CLASS**
Vinylsulphonyl	—	Trichloropyrimidinyl	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Bright Yellowish Red	Yellowish Orange	Bright Orange	**HUE** Daylight
—	—	Redder	Artificial light (tungsten)
Padded with $NaHCO_3$ and urea; fixed by steaming or dry heat	Pad-steam or pad-bake processes	Batchwise exhaustion, 50→80–85°C	**DYEING** Cellulose
—	—	—	Nylon
—	—	Salt + Na_3PO_4, 50→85°C	Silk
—	—	Weak acetic acid, 50°→boil	Wool
Cellulose: with $NaHCO_3$ and a neutral alginate thickener; fixed by neutral steaming Discharge styles	Cellulose: alkaline print paste with alginate or emulsion thickening; fixed by neutral steam or baking		**PRINTING**
Cotton ISO	Cotton ISO	Cotton ISO	**FASTNESS PROPERTIES** Fibre Method
2	—	—	Alkali
—	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
5	6	6	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
5–6	7	6–7	normal
—	7	—	2× normal
—	4–5	4–5	Peroxide Bleach — Alteration
—	4–5	5	Staining
5	—	4–5	Perspiration — Alteration
5	—	5	Staining
—	—	—	Soda Boil — Alteration
—	—	—	Staining
5 (75°C)	5	5	Washing — Alteration
4–5	5	5	Staining
Dischargeable to white	Poor (alkaline)	Good (4–5)	**OTHER PROPERTIES** Dischargeability
—	—	—	Effect of Metals — Copper
—	—	—	Iron
—	Yellow; yellowish orange on diln.	—	Reactions in Substance H_2SO_4 conc.
—	—	—	Dilute HCl
—	—	—	Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: good	Suitable for crease-resist finishes	Solubility in water: very good Suitable for crease-resist finishes; little effect on hue and light fastness	**NOTES**

C.I. Reactive Orange	10	11	12	
CHEMICAL CLASS	Azo	Azo	Monoazo	
REACTIVE SYSTEM	—	—	—	
C.I. CONSTITUTION NO.	—	—	—	
HUE				
Daylight	Bright Orange	Orange	Yellowish Orange	
Artificial light (tungsten)	Redder	Much redder	Redder	
DYEING				
Cellulose	Continuous, pad(alkali)-batch and batchwise processes	Pad-fix (dry heat): continuous processes	4 (a, b), 5 (a, b), 6 (a, b, c)	
Nylon	—	Stained	Formic acid (levelling poor)	
Silk	Salt + Na_3PO_4 at 50→85°C	—	—	
Wool	Acetic acid + cationic agent at 50→100°C	—	Acid (for ingrain effects). Acetic acid + cationic agent for level dyeing	
PRINTING	Cellulose, silk and wool: as for C.I. Reactive Yellow 8		Cellulose: suitable for most printing processes Printing of silk and chlorinated wool	
FASTNESS PROPERTIES				
Fibre	Cotton	Cotton	Cotton	Viscose
Method	ISO	ISO	ISO	ISO
Alkali	—	1	4–5 (redder)*	4 (redder)*
Burnt Gas Fumes	—	—	5	4–5
Carbonising — Alkaline rinse	—	—	—	—
Neutral rinse	—	—	—	—
Decatising	—	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	5	5–6	—	—
normal	6	6–7	6†	6–7
2× normal	—	—	6	6–7
Peroxide Bleach — Alteration	2	—	5	—
Staining	5	—	5	—
Perspiration — Alteration	4–5	5	5	4–5 (redder)
Staining	5	5	5	—
Soda Boil — Alteration	—	—	4 (greener)	—
Staining	—	—	5	—
Washing — Alteration	4–5	3–4 (5×95°C)	5 (5×100°C)	5 (5×100°C)
Staining	5	5	5	5
OTHER PROPERTIES				
Dischargeability	5	3	Good–moderate	
Effect of Metals — Copper	—	—	4 (weaker, greener)	
Iron	—	—	4–5 (redder)	
Reactions in Substance				
H_2SO_4 conc.	—	—	—	
Dilute HCl	—	—	—	
Dilute NaOH	—	—	—	
NON-TEXTILE USAGE				
NOTES	Solubility in water: very good Suitable for crease-resist finishes, becoming paler without effect on light fastness	Solubility in water: >100 g/l Good stability in hard water Good coverage of dead cotton and barré viscose Acrylics stained, acetate, triacetate and polyester unstained. Suitable for crease-resist finishes	Solubility in water: 200 g/l at 50°C High substantivity for cellulose Does not cause tendering or catalytic fading Suitable for crease-resist finishes (yellower; slight loss of light fastness) and for goods to be vulcanised *Na_2CO_3 †Light fastness 6 on wool, 6–7 on silk	

13	14	15	C.I. Reactive Orange
Monoazo	Monoazo (pyrazolone)	Monoazo	**CHEMICAL CLASS**
—	—	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Reddish Orange	Bright Yellowish Orange	Reddish Orange	**HUE** Daylight
Redder	Orange	Yellower	Artificial light (tungsten)
4 (a, b), 5 (a, b), 6 (a, b, c)	Main application	Pad-fixation processes. Unsuitable for exhaustion dyeing	**DYEING** Cellulose
Formic acid (levelling poor)	Suitable	—	Nylon
—		—	Silk
Acid (for ingrain effects). Acetic acid + cationic agent for level dyeing		—	Wool
Cellulose: suitable for most printing processes. Printing of silk and chlorinated wool Unsuitable for printing with C.I. Azoic Coupling Component 2			**PRINTING**
Cotton ISO	Cotton* ISO	Cotton ISO	Viscose ISO	**FASTNESS PROPERTIES** Fibre Method
5 (Na_2CO_3)	4 (redder)	2	—	Alkali
4 (yellower)	—	—	—	Burnt Gas Fumes
—	—	—	—	Carbonising — Alkaline rinse
—	—	—	—	Neutral rinse
—	—	—	—	Decatising
—*	—	5	—	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
4 (weaker, redder)	5	6–7	—	normal
4 (weaker, redder)	—	—	—	2× normal
4–5	—	—	—	Peroxide Bleach — Alteration
4–5	—	—	—	Staining
4–5 (yellower)	5	5	5	Perspiration — Alteration
4	5	5	5	Staining
5 (open kier)	—	—	—	Soda Boil — Alteration
4–5	—	—	—	Staining
4–5 (redder) (5×100°C)	4–5 (95°C)	4–5 (75°C)	5 (75°C)	Washing — Alteration
5	5	5	5	Staining
Good–moderate	Good (on wool)	Good		**OTHER PROPERTIES** Dischargeability
1 (redder, duller)	—	—		Effect of Metals — Copper
5	—	—		Iron
—	—	—		Reactions in Substance H_2SO_4 conc.
—	—	—		Dilute HCl
—	—	—		Dilute NaOH
				NON-TEXTILE USAGE
Solubility in water: 160 g/l at 50°C Low substantivity for cellulose Suitable for goods to be vulcanised; also for crease-resist finishes (light fastness slightly reduced) *Light fastness on wool and silk 4–5 (Normal), 5 (2×Normal)	Solubility in water: 60 g/l Suitable for crease-resist finishes (reduced light fastness) *Fastness on silk: light 5, washing at 60°C 5, 5; on nylon: light 5; on wool: light 5–6	Solubility in water: 120 g/l at 100°C Acetate, nylon heavily stained; triacetate slightly stained; acrylics and polyester unstained Suitable for crease-resist finishes		**NOTES**

C.I. Reactive Orange	16	17	18
CHEMICAL CLASS	Monoazo	Azo	Azo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Bright Yellowish Red	Bright Orange	Bright Reddish Orange
Artificial light (tungsten)	—	—	—
DYEING			
Cellulose	Pad-batch method	Main application	Main application
Nylon	—	Suitable	Suitable
Silk	—		
Wool	—		
PRINTING			
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton*	Cotton*
Method	ISO		ISO
Alkali	—	4–5	5
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	—	—
normal	5–6	5	4
2× normal	—	—	—
Peroxide Bleach — Alteration	—	—	—
Staining	—	—	—
Perspiration — Alteration	5	5	5
Staining	4–5	4–5	4–5
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	3 (95°C)	4–5 (95°C)	4–5 (95°C)
Staining	4–5	4–5	4–5
OTHER PROPERTIES			
Dischargeability		Good (wool)	Good (wool)
Effect of Metals — Copper		—	—
Iron		—	—
Reactions in Substance			
H_2SO_4 conc.		—	—
Dilute HCl		—	—
Dilute NaOH		—	—
NON-TEXTILE USAGE			
NOTES	Solubility in water: 60 g/l Suitable for crease-resist finishes	Solubility in water: 100 g/l Suitable for crease-resist finishes (reduced light fastness) *Fastness on silk: light 4; washing (60°C) 5, 5; on wool: light 5–6; on nylon: light 3–4	Solubility in water: 100 g/l Suitable for crease-resist finishes (slightly reduced light fastness) *Fastness on silk: light 2–3; washing (60°C) 5, 5; on nylon: light 3; on wool: light 4

19	20	C.I. Reactive Orange
Azo (2:1 Dye: metal complex)	Azo	**CHEMICAL CLASS**
—	—	**REACTIVE SYSTEM**
—	—	**C.I. CONSTITUTION NO.**
Dull Yellowish Orange	Bright Yellowish Orange	**HUE** Daylight
Redder	Redder	Artificial light (tungsten)
—	Exhaustion, pad-steam, -thermofix, -roll, -jig, -batch	**DYEING** Cellulose
—	Stained	Nylon
—	—	Silk
Ammonium acetate or sulphate+acetic acid (pH 6–6·5); fixed by boiling	Exhaustion; fixed by boiling	Wool
	Cellulose: unsuitable	**PRINTING**
Wool ISO	Cotton ISO	**FASTNESS PROPERTIES** Fibre Method
— — 4–5 (redder) 4–5 —	4–5 (redder) — — — —	Alkali Burnt Gas Fumes Carbonising — Alkaline rinse Neutral rinse Decatising
7 7 7	4 5 5	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal
5 5 5 5	4 (yellower) — 3–4 (yellower) (alkaline) 3–4	Peroxide Bleach — Alteration Staining Perspiration — Alteration Staining
— — 4–5 (redder) 5	4 (yellower) 2–3 4 (yellower) 4–5	Soda Boil — Alteration Staining Washing — Alteration Staining
— 4 (yellower, duller) 3–4 (yellower, duller)	Good (vat discharge); poor neutral 4 5	**OTHER PROPERTIES** Dischargeability Effect of Metals — Copper Iron
— — —	Bluish red No change Reddish orange	Reactions in Substance H_2SO_4 conc. Dilute HCl Dilute NaOH
		NON-TEXTILE USAGE
Solubility in water: 20 g/l at 90°C Effect of chromium in dyebath: 3 (duller)	Solubility in water: 120 g/l at 60°C Not sensitive to hard water Acetate, acrylic and polyester unstained Suitable for crease-resist finishes	**NOTES**

C.I. Reactive Orange	21	22
CHEMICAL CLASS	Azo (metallised)	Azo (metallised)
REACTIVE SYSTEM	—	—
C.I. CONSTITUTION NO.	—	—
HUE		
Daylight	Dull Reddish Orange	Dull Orange
Artificial light (tungsten)	—	—
DYEING		
Cellulose	Alkaline pad liquor containing urea; one-bath pad-steam or heat fixation*	See C.I. Reactive Orange 21*
Nylon	—	—
Silk	—	—
Wool	—	—
PRINTING	Cellulose: alkaline paste containing urea and special assistant, thickened with alginate; dried and fixed with neutral steam	Cellulose: see C.I. Reactive Orange 21
FASTNESS PROPERTIES		
Fibre	Cotton	Cotton
Method	ISO	ISO
Alkali	—	—
Burnt Gas Fumes	—	—
Carbonising — Alkaline rinse	—	—
Neutral rinse	—	—
Decatising	—	—
Light — ½–½ normal	4	5–6
normal	5	6
2× normal	—	—
Peroxide Bleach — Alteration	3–4	4–5
Staining	4–5	5
Perspiration — Alteration	2	5 (alkaline)
Staining	4–5	4–5
Soda Boil — Alteration	—	—
Staining	—	—
Washing — Alteration	4	4–5
Staining	4–5	5
OTHER PROPERTIES		
Dischargeability	—	—
Effect of Metals — Copper	—	—
Iron	—	—
Reactions in Substance		
H_2SO_4 conc.	Yellow; yellowish orange on dilution	Yellowish orange; on dilution—orange
Dilute HCl	—	—
Dilute NaOH	Decolorised	Weaker
NON-TEXTILE USAGE		
NOTES	Solubility in water: 100 g/l Suitable for crease-resist finishes *This dye does not react directly with the fibre, but requires the use of a fixing agent	Solubility in water: 100 g/l Suitable for crease-resist finishes *This dye does not react directly with the fibre, but requires the use of a fixing agent

23	24	C.I. Reactive Orange
Monoazo	Monoazo	**CHEMICAL CLASS**
—	—	**REACTIVE SYSTEM**
—	—	**C.I. CONSTITUTION NO.**
Bright Orange	Reddish Orange	**HUE** Daylight
—	Yellower	Artificial light (tungsten)
Padded with $NaHCO_3$ and urea; fixed by steaming or dry heat	Applied alone or in mixtures by padding processes	**DYEING** Cellulose
—	—	Nylon
—	—	Silk
—	—	Wool
Cellulose: with $NaHCO_3$ and a neutral alginate thickener; fixed by neutral steaming Also discharge styles	Cellulose: direct or discharge styles	**PRINTING**
Cotton ISO	Cotton ISO	**FASTNESS PROPERTIES** Fibre Method
2 (redder)	2 (bluer)	Alkali
—	—	Burnt Gas Fumes
—	—	Carbonising — Alkaline rinse
—	—	Neutral rinse
—	—	Decatising
5	5	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
5	6	normal
5–6	6	2× normal
—	—	Peroxide Bleach — Alteration
—	—	Staining
5	4–5	Perspiration — Alteration
5	5	Staining
—	—	Soda Boil — Alteration
—	—	Staining
4 (95°C)	5 (AATCC No.3)	Washing — Alteration
4	5	Staining
Good	Good	**OTHER PROPERTIES** Dischargeability
—	—	Effect of Metals — Copper
—	—	Iron
—	—	Reactions in Substance H_2SO_4 conc.
—	—	Dilute HCl
—	—	Dilute NaOH
		NON-TEXTILE USAGE
	Solubility in water: 100 g/l at the boil Suitable for certain crease-resist finishes and for PVC coating	**NOTES**

C.I. Reactive Orange	25	26	27
CHEMICAL CLASS	Azo	Azo (metal complex)	Azo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Orange	Reddish Orange	Yellowish Orange
Artificial light (tungsten)	Redder	Yellower	Redder
DYEING			
Cellulose	—	—	Main application
Nylon	—	—	—
Silk	—	—	—
Wool	—	At pH 6, 70°C	Weak acid
PRINTING	Cellulose: thermofix and steaming processes		Direct, with $NaHCO_3$; fixed by steaming
FASTNESS PROPERTIES			
Fibre	Cotton	Wool	Cellulose
Method	ISO	ISO	ISO
Alkali	—	—	4 (redder)
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	5	—
Neutral rinse	—	4–5	—
Decatising	—	4–5	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	5	—	5
normal	5–6	6	6
2× normal	—	6–7	—
Peroxide Bleach — Alteration	—	5	4
Staining	—	4	—
Perspiration — Alteration	4–5	5	—
Staining	4–5	5	—
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	4–5 (Test 4)	4–5 (ISO 3)	4–5 (60°C)
Staining	4–5	4–5	—
OTHER PROPERTIES			
Dischargeability	Good	—	Neutral good; alkaline poor
Effect of Metals — Copper	—	4	Slightly greener
Iron	—	4	Slightly duller
Reactions in Substance			
H_2SO_4 conc.	Fuchsine red; on diln—orange	—	—
Dilute HCl	—	—	—
Dilute NaOH	(4%) Unaltered	—	—
NON-TEXTILE USAGE		Clothing leathers	
NOTES	Solubility in water: 150 g/l at 90°C Suitable for crease-resist finishes	Staining acetate 4–5, cotton 3–4, nylon 1, polyester 4–5, silk 2, viscose 3–4	Solubility in water: very good Suitable for crease-resist finishes

28	29	30	C.I. Reactive Orange
Azo	Azo	Monoazo	CHEMICAL CLASS
—	—	—	REACTIVE SYSTEM
—	—	—	C.I. CONSTITUTION NO.
Bright Orange	Yellowish Orange	Yellowish Orange	HUE Daylight
Redder	Redder	Yellower	Artificial light (tungsten)
Main application	—	Cold pad-batch process; may be fixed by neutral steam or dry heat	DYEING Cellulose
—	—	—	Nylon
—	Suitable	—	Silk
Weak acid	Exhaustion dyeing	—	Wool
Cellulose: direct, with $NaHCO_3$; fixed by steaming	Wool and silk	Printed with urea, soda ash and alginate or emulsion thickening; fixed by neutral steam at 101–103°C or baking	PRINTING
Cellulose ISO	Wool ISO	Cotton ISO	FASTNESS PROPERTIES Fibre Method
4	—	—	Alkali
—	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
4	4–5	6	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
5	5	6	normal
—	6	—	2× normal
4	—	5	Peroxide Bleach — Alteration
—	—	5	Staining
—	—	5	Perspiration — Alteration
—	—	4	Staining
—	—	4	Soda Boil — Alteration
—	—	4	Staining
4–5 (60°C)	4 (yellower)	4–5	Washing — Alteration
—	5	5	Staining
Neutral good; alkaline poor	Very good	Not dischargeable to white	OTHER PROPERTIES Dischargeability
Slightly redder	4 (yellower, duller)	—	Effect of Metals — Copper
Slightly redder and duller	5	—	Iron
Red; on diln—orange, with ppt.	Reddish orange	—	Reactions in Substance H_2SO_4 conc.
Unchanged	Reddish orange	—	Dilute HCl
Red	Golden orange	—	Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: very good Suitable for crease-resist finishes; hue becomes yellower	Solubility in water: very good Good wet fastness on chlorinated wool	Print paste is stable at 20°C for more than 28 days Suitable for crease-resist finishes and for PVC coating	NOTES

C.I. Reactive Orange	31	32	33
CHEMICAL CLASS	Monoazo	Monoazo	Monoazo (chromium complex)
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Yellowish Orange	Reddish Orange	Yellowish Orange
Artificial light (tungsten)	Redder	Brighter	Redder
DYEING			
Cellulose	Pad-fix processes; or applied from a hot neutral salt or Na_2SO_4 bath and fixed with alkali	As C.I. Reactive Orange 31	Ammonium acetate or sulphate + special assistant*
Nylon	Acid		—
Silk	Salt + Na_3PO_4		—
Wool	Acid + cationic assistant		—
PRINTING	Cellulose: direct, with soda ash, urea, a reduction inhibitor and alginate or emulsion thickener; fixed by steaming	As C.I. Reactive Orange 31	
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Wool
Method	ISO	ISO	ISO
Alkali	—	—	4–5 (redder)
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	4–5 (redder)
Neutral rinse	—	—	5
Decatising	—	—	5
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	5–6	5	—
normal	6	5–6	6–7
2× normal	—	—	6–7
Peroxide Bleach — Alteration	4–5	4	4–5 (redder)
Staining	5	4–5	5
Perspiration — Alteration	—	—	5
Staining	—	—	5
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	4–5	4–5	4–5 (ISO 3)
Staining	5	4–5	5
OTHER PROPERTIES			
Dischargeability	Very good	Not dischargeable	—
Effect of Metals — Copper	Not sensitive	Unaffected	4 (greener, duller)
Iron	Not sensitive	Unaffected	5
Reactions in Substance			
H_2SO_4 conc.	Brown	Brown	—
Dilute HCl	Redder	Redder	—
Dilute NaOH	Yellower	Browner	—
NON-TEXTILE USAGE			Clothing leathers
NOTES	Solubility in water: good	Solubility in water: good	Solubility in water: 180 g/l at 90°C Staining of effect threads: acetate 4–5, cotton 4, nylon 1, polyester 4, silk 2–3, viscose 3–4 *Fixation may be increased by prolonged boiling or by increasing pH to 8–8·5; fastness to cross-dyeing, milling and potting is thereby improved

34	35	36	C.I. Reactive Orange
—	Azo	Azo	CHEMICAL CLASS
—	—	—	REACTIVE SYSTEM
—	—	—	C.I. CONSTITUTION NO.
Reddish Orange	Reddish Orange	Bright Reddish Orange	HUE Daylight
Little yellower	Slightly redder	—	Artificial light (tungsten)
Exhaustion dyeing	4 (a, b), 5 (a, b), 6 (a, b, c)	1 (a, b, c), 2 (a, b), 3 (a, b, c)	DYEING Cellulose
—	—	Suitable	Nylon
—	—		Silk
—	—		Wool
	Cellulose: steaming, high-temperature steaming, baking, flash-age and wet development processes. May be applied with C.I. Azoic Coupling Component 5 (but not 2)*	Direct on cellulose, nylon, silk and wool	PRINTING
Cotton ISO	Cellulose ISO	Cotton ISO	FASTNESS PROPERTIES Fibre Method
1–2	4–5 (redder)	—	Alkali
—	4 (yellower)	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
5	5–6	—	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
5–6	6	4–5	normal
—	6–7	—	2× normal
—	5	—	Peroxide Bleach — Alteration
—	5	—	Staining
5	5	4–5	Perspiration — Alteration
5	5	—	Staining
—	4	—	Soda Boil — Alteration
—	5	—	Staining
4–5 (5×95°C)	4–5 (Test 4)	3–4 (5×95°C)	Washing — Alteration
5	5	—	Staining
5 (non-exposed); 4 (exposed)	Poor (neutral and alkaline)	Moderate	OTHER PROPERTIES Dischargeability
—	4	—	Effect of Metals — Copper
—	4–5	—	Iron
—	Greenish blue; on diln—reddish orange	—	Reactions in Substance H_2SO_4 conc.
—	Yellowish orange	—	Dilute HCl
—	Yellowish orange	—	Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: 100 g/l at 30°C Suitable for crease resist finishes (hue unchanged; light fastness may be affected) Good stability to hard water	Solubility in water: very good Suitable for crease-resist finishes; hue becomes slightly yellower *Suitable for printing on chlorinated wool, nylon, silk and polyester-cotton unions Print paste is stable for more than 28 days	Solubility in water: good	NOTES

C.I. Reactive Orange	37	38	39
CHEMICAL CLASS	Azo	Azo	Azo (1:2 chromium complex)
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Bright Reddish Orange	Bright Reddish Orange	Dull Yellowish Orange
Artificial light (tungsten)	—	—	—
DYEING			
Cellulose	1 (a, b, c), 2 (a, b), 3 (a, b, c)	1 (a, b, c), 2 (a, b), 3 (a, b, c)	One-bath pad-steam and thermofixation processes
Nylon	Suitable	Suitable	—
Silk			—
Wool			—
PRINTING	Direct on cellulose, nylon, silk and wool	Direct on cellulose, nylon, silk and wool	Cellulose and nylon: steaming, hot air, two-phase and rapid steaming processes
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	—	—	—
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	—	6–7
normal	4–5	4	7
2× normal	—	—	—
Peroxide Bleach — Alteration	—	—	4–5
Staining	—	—	5
Perspiration — Alteration	4–5	4	5
Staining	—	—	5
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	3–4 (5×95°C)	3 (5×95°C)	4–5 (test 4)
Staining	—	—	5
OTHER PROPERTIES			
Dischargeability	Moderate		Dischargeable to white
Effect of Metals — Copper	—		—
Iron	—		—
Reactions in Substance			
H_2SO_4 conc.	—		—
Dilute HCl	—		—
Dilute NaOH	—		—
NON-TEXTILE USAGE			
NOTES	Solubility in water: good		Solubility: 75 g/kg paste Print paste is stable for 4 weeks Suitable for PVC coating Unsuitable for overprinting with caustic alkali

40	41	42	C.I. Reactive Orange
Monoazo	Monoazo	Azo	**CHEMICAL CLASS**
—	—	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Orange	Orange	Yellowish Orange	**HUE** Daylight
Unchanged	No change	—	Artificial light (tungsten)
—	Pad-cure and one-bath pad-steam processes	Pad-cure and one-bath pad-steam processes	**DYEING** Cellulose
—	—	—	Nylon
—	—	—	Silk
—	—	—	Wool
Cellulose: steaming, high-temperature steaming, baking, flash-age (two-phase) and wet-development processes Suitable for printing on cellulose-polyester unions but not on nylon*	Neutral steam process (cotton and viscose)	Neutral steam	**PRINTING**
Cotton	Cotton	Cotton	**FASTNESS PROPERTIES** Fibre
ISO	ISO	ISO	Method
2 (yellower)	2–3 (duller)	4–5	Alkali
5	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
—	3	4	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
4–5	3–4	4	normal
5	4	—	2× normal
—	3–4 (duller)	5	Peroxide Bleach — Alteration
—	5	—	Staining
4	5	5 (alkaline)	Perspiration — Alteration
4–5	5	5	Staining
—	4–5	4–5	Soda Boil — Alteration
—	5	4	Staining
4–5 (ISO 4)	4–5 (5 × 95°C)	5 (95°C)	Washing — Alteration
5	5	—	Staining
Very good (alkaline and neutral)	Not dischargeable (neutral)	Very good	**OTHER PROPERTIES** Dischargeability
—	—	—	Effect of Metals — Copper
—	—	—	Iron
—	—	—	Reactions in Substance H_2SO_4 conc.
—	—	—	Dilute HCl
—	—	—	Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: very good Rapid washing off *Print paste is stable for more than 28 days	Solubility in water: 100 g/l at 77°C Print paste is stable for more than 28 days Suitable for overprinting with caustic alkali and for PVC coating	Solubility in water: 70 g/l Print paste is stable for more than 28 days Suitable for overprinting with caustic alkali	**NOTES**

C.I. Reactive Orange	43	44	45
CHEMICAL CLASS	Azo	Monoazo	Monoazo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Reddish Orange	Bright Orange	Bright Yellowish Orange
Artificial light (tungsten)	—	—	—
DYEING			
Cellulose	Pad-cure and one-bath pad-steam processes	This application is possible but has no special advantage	This application is possible but has no special advantage
Nylon	—	—	—
Silk	—	—	—
Wool	—	—	—
PRINTING	Neutral steam	Cellulose, chlorinated wool and unions: one- and two-step fixation methods	Cellulose, chlorinated wool and unions: one- and two-step fixation methods
FASTNESS PROPERTIES			
Fibre	Cotton	Cellulose	Cellulose
Method	ISO	ISO	ISO
Alkali	4	3–4	3–4
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	3–4	4–5	6
normal	4	5	6–7
2× normal	—	—	—
Peroxide Bleach — Alteration	4–5	4	4–5
Staining	5	—	—
Perspiration — Alteration	5	—	—
Staining	5	—	—
Soda Boil — Alteration	4	—	—
Staining	4	—	—
Washing — Alteration	5 (95°C)	4–5	4–5 (ISO 4)
Staining	5	—	—
OTHER PROPERTIES			
Dischargeability	Dischargeable to white (alk)*	Poor	Good (alkaline)
Effect of Metals — Copper	—	—	—
Iron	—	—	—
Reactions in Substance			
H_2SO_4 conc.	—	—	Reddish brown
Dilute HCl	—	—	—
Dilute NaOH	—	Bordeaux	Reddish
NON-TEXTILE USAGE			
NOTES	Solubility in water: 10 g/l Print paste is stable at 20°C for more than 28 days Suitable for overprinting with caustic alkali *Under neutral conditions dischargeable to white up to 20 g/l dye in the pad liquor	Solubility in water: very good Suitable for crease-resist finishes	Solubility in water: very good Suitable for crease-resist finishes

46	47	48	C.I. Reactive Orange
Disazo	Azo	Monoazo	CHEMICAL CLASS
—	—	—	REACTIVE SYSTEM
—	—	—	C.I. CONSTITUTION NO.
Reddish Orange	Orange	Yellowish Orange	HUE
—	Yellower	Slightly redder, brighter	Daylight
			Artificial light (tungsten)
This application is possible but has no special advantage	Exhaustion or pad-batch (cold)		DYEING
—	—		Cellulose
—	—		Nylon
—	—		Silk
			Wool
Cellulose, chlorinated wool and unions: one- and two-step fixation methods		Pad-steam, pad-(alkali shock) processes	PRINTING
Cellulose	Cotton	Cotton	FASTNESS PROPERTIES
ISO	ISO	ISO	Fibre
			Method
4	1–2	2 (greener, weaker)	Alkali
—	—	2 (redder)	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
6	5	5	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
6–7	5–6	5–6	normal
—	—	—	2× normal
4–5	2–3	—	Peroxide Bleach — Alteration
—	4	—	Staining
—	5	5	Perspiration — Alteration
—	4–5	4–5	Staining
—	2	—	Soda Boil — Alteration
—	2–3	—	Staining
4–5 (ISO 4)	4 (95°C)	3 (redder, duller) (95°C)	Washing — Alteration
—	4	5	Staining
Poor	Moderate–poor	5 (neutral or alkaline)	OTHER PROPERTIES
—	—	—	Dischargeability
—	—	—	Effect of Metals — Copper
			Iron
Black	—	—	Reactions in Substance
—	—	—	H_2SO_4 conc.
—	—	—	Dilute HCl
			Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: very good Suitable for crease-resist finishes	Suitable for crease-resist finishes; there may be some change in hue, and light fastness is reduced Acetate, triacetate and nylon slightly stained, acrylic and polyester unstained	Solubility in water: 100 g/l	NOTES

C.I. Reactive Orange	49	50	51
CHEMICAL CLASS	Monoazo	Azo	Monoazo
REACTIVE SYSTEM	—	—	Dichlorophthalazinecarbonyl
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Orange	Bright Orange	Yellowish Orange
Artificial light (tungsten)	Brighter	—	Little or no change
DYEING			
Cellulose	Applied by padding and fixed by dry heat (acid catalyst)	Suitable	Pad-thermofix, pad-batch, pad-steam, pad-roll, pad-jig or exhaustion
Nylon	—	—	—
Silk	—	—	—
Wool	—	—	—
PRINTING	Cellulose: direct printing, with fixation by dry heat (acid catalyst)	Cellulose	Cellulose: printed with urea and $NaHCO_3$ or Na_2CO_3 and fixed by steaming; thermofix, flash-age (2-phase) or alkali shock processes. Printing paste is stable for more than 4 weeks
FASTNESS PROPERTIES			
Fibre	Cotton	Cellulose	Cotton
Method	AATCC	AATCC	ISO
Alkali	—	—	4 (redder)
Burnt Gas Fumes	—	—	5
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	—	5–6
normal	—	5	6–7
2× normal	—	—	—
Peroxide Bleach — Alteration	—	—	4
Staining	—	—	5
Perspiration — Alteration	3	—	5
Staining	—	—	5
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	3	4–5 (AATCC)	3–4 (ISO No.4)
Staining	—	—	5
OTHER PROPERTIES			
Dischargeability			4 (neutral or alkaline)
Effect of Metals — Copper			—
Iron			—
Reactions in Substance			
H_2SO_4 conc.			—
Dilute HCl			—
Dilute NaOH			—
NON-TEXTILE USAGE			
NOTES	Literature: *BP* 1,100,599 McCleary, Cate, Fordemwalt and Loffelman, *Am. Dyestuffs Rep.*, 1967, **56**, P46–51		Solubility in water: 100 g/l at 60°C, 150 g/l at 90°C

52	53	54	C.I. Reactive Orange
Monoazo	Azo	Monoazo	**CHEMICAL CLASS**
Dichlorophthalazinecarbonyl	—	Monochlorotriazinyl	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Reddish Orange	Orange	Bright Orange	**HUE** Daylight
4 (yellower)	Somewhat redder	Redder	Artificial light (tungsten)
As for C.I. Reactive Orange 51	Stained	Exhaustion, pad-thermofix, pad-jig or pad-roll method	**DYEING** Cellulose
—	Dyed	—	Nylon
—	Heavily stained	—	Silk
—	pH 4·5–5; acetic acid + Na_2SO_4 + auxiliary*	Weakly acid bath	Wool
Cellulose: as for C.I. Reactive Orange 51		Cellulosic fibres	**PRINTING**
Cotton ISO	Wool ISO	Cellulose ISO	**FASTNESS PROPERTIES** Fibre Method
4	4–5	4	Alkali
5	—	—	Burnt Gas Fumes
—	4	—	Carbonising — Alkaline rinse
—	4	—	Neutral rinse
—	4–5	—	Decatising
5	5–6	4	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
6	6	5	normal
—	6–7	—	2× normal
4	4–5	4	Peroxide Bleach — Alteration
5	5	4	Staining
4–5	5 (acid or alkaline)	4	Perspiration — Alteration
4–5	5	4	Staining
—	—	—	Soda Boil — Alteration
—	—	—	Staining
4–5 (ISO No.4)	4–5 (5 × 60°C)	4	Washing — Alteration
5	5	4	Staining
3–4 neutral, 5 alkaline	3–4	Neutral: good; alk.: moderate	**OTHER PROPERTIES** Dischargeability
—	4	Slightly greener	Effect of Metals — Copper
—	4–5	Slightly greener	Iron
—	—	—	Reactions in Substance H_2SO_4 conc.
—	—	—	Dilute HCl
—	—	—	Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: 150 g/l at 30°C, 200 g/l at 90°C	Solubility in water: 91–100 g/l *May be aftertreated with ammonia for deep dyeings on wool or chlorinated wool	Solubility in water: very good	**NOTES**

C.I. Reactive Orange	55	56	57
CHEMICAL CLASS	Monoazo	Monoazo	Monoazo
REACTIVE SYSTEM	Vinylsulphonyl	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Orange	Reddish Orange	Yellowish Orange
Artificial light (tungsten)	—	—	—
DYEING			
Cellulose	1 (a, b, c), 2 (a, b), 3 (a, b, c)	Padded cold with urea + $NaHCO_3$; fixed by steam or dry heat	Padded cold with urea + $NaHCO_3$; fixed by steam or dry heat
Nylon	—	—	—
Silk	—	—	—
Wool	—	—	—
PRINTING	Cellulose: printed with $NaHCO_3$, urea and a neutral alginate thickener; fixed by neutral steam or dry heat	Cellulose: direct processes, print paste containing $NaHCO_3$ and a neutral alginate thickener; fixation by neutral steam	Cellulose: direct processes, print paste containing $NaHCO_3$ and a neutral alginate thickener; fixation by neutral steam
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	—	3–4	1
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	—	—
normal	6	5	5
2× normal	—	—	—
Peroxide Bleach — Alteration	—	—	—
Staining	—	—	—
Perspiration — Alteration	3–4	5	5
Staining	5	5	5
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	3–4 (95°C)	5 (70°C)	5 (70°C)
Staining	5	5	5
OTHER PROPERTIES			
Dischargeability		Dischargeable to white	Dischargeable to white
Effect of Metals — Copper		—	—
Iron		—	—
Reactions in Substance			
H_2SO_4 conc.		—	—
Dilute HCl		—	—
Dilute NaOH		—	—
NON-TEXTILE USAGE			
NOTES		Solubility in water: good	Solubility in water: good

58	59	60	C.I. Reactive Orange
Monoazo	Monoazo	Monoazo	**CHEMICAL CLASS**
—	Monochlorotriazine	Dichlorotriazine	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Orange	Bright Yellowish Orange	Bright Reddish Orange	**HUE** Daylight
—	Redder	Redder	Artificial light (tungsten)
Padded cold with urea + $NaHCO_3$; fixed by steam or dry heat	As for C.I. Reactive Yellow 2	As for C.I. Reactive Yellow 1	**DYEING** Cellulose
—			Nylon
—			Silk
—			Wool
Cellulose: direct processes, print paste containing $NaHCO_3$ and a neutral alginate thickener; fixation by neutral steam	As for C.I. Reactive Yellow 2	As for C.I. Reactive Yellow 1	**PRINTING**
Cotton ISO	Cotton ISO	Cotton ISO	**FASTNESS PROPERTIES** Fibre Method
1	—	—	Alkali
—	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
—	4	3	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
5	4–5	4	normal
—	4–5	4	2× normal
—	2	5	Peroxide Bleach — Alteration
—	—	—	Staining
5	—	—	Perspiration — Alteration
5	—	—	Staining
—	—	—	Soda Boil — Alteration
—	—	—	Staining
5 (70°C)	5	5	Washing — Alteration
5	—	—	Staining
Dischargeable to white	—	—	**OTHER PROPERTIES** Dischargeability
—	—	—	Effect of Metals — Copper
—	—	—	Iron
—	—	—	Reactions in Substance H_2SO_4 conc.
—	—	—	Dilute HCl
—	—	—	Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: good	Fastness to Hypochlorite 1	Fastness to Hypochlorite 4	**NOTES**

C.I. Reactive Red 1—3

C.I. Reactive Red	1	2	3
CHEMICAL CLASS	Monoazo	Monoazo	Monoazo
REACTIVE SYSTEM	Dichlorotriazinyl	Dichlorotriazinyl	Monochlorotriazinyl
C.I. CONSTITUTION NO.	**18158**	—	**18159**
HUE			
Daylight	Bright Bluish Red	Bright Bluish Red	Bright Bluish Red
Artificial light (tungsten)	Yellower	Yellower	Little yellower
DYEING			
Cellulose	1 (a, b, c), 2 (a, b), 3 (a, b, c)	1 (a, b, c), 2 (a, b), 3 (a, b, c)	4 (a, b), 5 (a, b), 6 (a, b, c)
Nylon	As for C.I. Reactive Yellow 1	As for C.I. Reactive Yellow 1	Formic acid (levelling poor)
Silk			As for C.I. Reactive Yellow 3
Wool			As for C.I. Reactive Yellow 1
PRINTING	Cellulose, silk and wool: as for C.I. Reactive Yellow 1	Cellulose, nylon, silk and wool: as for C.I. Reactive Yellow 1	Cellulose, nylon, silk and wool: as for C.I. Reactive Yellow 2
FASTNESS PROPERTIES			
Fibre	Cotton*	Cotton*	Cotton*
Method	ISO	ISO	ISO
Alkali	2 (bluer)	2 (yellower, duller)	2 (bluer, duller)
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	—	—
normal	5	4	5
2× normal	5–6	4–5	5
Peroxide Bleach — Alteration	2 (weaker, bluer)	2 (weaker, bluer)	4 (weaker, bluer)
Staining	4–5	4–5	4–5
Perspiration — Alteration	4 (bluer)	5	—
Staining	4–5	3–4	—
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	3 (weaker, bluer) (5×100°C)	4 (5×100°C)	4 (bluer) (5×100°C)
Staining	4–5	4	4–5
OTHER PROPERTIES			
Dischargeability	Moderate white (pale dyeings)	Moderate white (pale dyeings)	To white (pale dyeings)
Effect of Metals — Copper	2 (weaker and bluer)	3 (weaker and duller)	1 (bluer)
Iron	4–5	Unaffected	Unaffected
Reactions in Substance			
H_2SO_4 conc.	—	—	—
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE			
NOTES	Solubility in water: very good *Fastness on nylon: light 4, 5, 5; peroxide bleaching 5, 5; washing (5×100°C) 5, 5. On silk: light 5, 5, 5–6; peroxide bleaching 3, 5; washing (5×100°C) 4–5, 5	Solubility in water: very good *Fastness on nylon: light 3–4, 4; peroxide bleaching 5, 5; washing (95°C) 4 (bluer), 5. On silk: light (pale) 3, 4–5; peroxide bleaching 3–4, 4–5; washing (95°C) 5, 5	Solubility in water: very good Suitable for printing on C.I. Azoic Coupling Components 2 and 5 *Fastness on nylon: light ($\frac{1}{25}$) 4, 4; peroxide bleaching 5, 5; washing (5×100°C) 3–4, 5. On silk: light ($\frac{1}{25}$) 3–4, 4; peroxide bleaching 5, 5; washing (95°C) 5

C.I. Reactive Red	4	5
CHEMICAL CLASS	Monoazo	Monoazo
REACTIVE SYSTEM	Monochlorotriazinyl	Dichlorotriazinyl
C.I. CONSTITUTION NO.	**18105**	—
HUE		
Daylight	Bright Bluish Red	Bright Red
Artificial light (tungsten)	Little yellower	Little yellower
DYEING		
Cellulose	4 (a, b), 5 (a, b), 6 (a, b, c)	1 (a, b), 2 (a, b), 3 (a, b, c)
Nylon	Formic acid (levelling poor)	As for C.I. Reactive Yellow 1
Silk	(Degummed): Na_2SO_4 at 70–90° or formic acid at 40→85°C; Na_2CO_3 added; soaped	
Wool	Acid (for ingrain effects). Acetic acid + cationic agent for level dyeing	
PRINTING	Cellulose, nylon, silk and wool: as for C.I. Reactive Yellow 2 Suitable for printing on C.I. Azoic Coupling Components 2 and 5	Cellulose, nylon, silk and wool: as for C.I. Reactive Yellow 1

FASTNESS PROPERTIES

Fibre / Method	Cotton ISO	Nylon ISO	Silk ISO	Cotton ISO	Nylon ISO	Silk ISO
Alkali	2–3 (bluer)	—	—	3 (bluer)	—	—
Burnt Gas Fumes	—	—	—	—	—	—
Carbonising — Alkaline rinse	—	—	—	—	—	—
Neutral rinse	—	—	—	—	—	—
Decatising	—	—	—	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	—	—	—	4	3–4
normal	4–5	4–5	4	4–5	5	4
2× normal	4–5	—	—	4–5	5	4
Peroxide Bleach — Alteration	4–5	4–5	5	3	5	3–4
Staining	4	5	5	5	5	5
Perspiration — Alteration	—	—	—	4–5 (bluer)	—	—
Staining	—	—	—	5	—	—
Soda Boil — Alteration	—	—	—	—	—	—
Staining	—	—	—	—	—	—
Washing — Alteration	4 (5×100°C)	4–5 (5×100°C)	5 (95°C)	4 (5×100°C)	4 (5×100°C)	5 (95°C)
Staining	4–5	5	5	5	5	5

OTHER PROPERTIES		
Dischargeability	Dischargeable to white	Dischargeable to white (pale dyeings)
Effect of Metals — Copper	1 (duller)	3
Iron	5	5
Reactions in Substance		
H_2SO_4 conc.	Bluer; on dilution—no change	—
Dilute HCl	No change	—
Dilute NaOH	Browner	—
NON-TEXTILE USAGE		
NOTES	Solubility in water: very good; not sensitive to hard water Suitable for crease-resist finishes (4, bluer)	

6	7	8	C.I. Reactive Red
Monoazo (copper complex) Dichlorotriazinyl **17965**	Monoazo (copper complex) Monochlorotriazinyl **17912**	Monoazo Dichlorotriazinyl **17908**	**CHEMICAL CLASS** **REACTIVE SYSTEM** **C.I. CONSTITUTION NO.**
Dull Bluish Red Yellower	Dull Bluish Red Little yellower	Bright Yellowish Red Little yellower	**HUE** Daylight Artificial light (tungsten)
1 (a, b, c), 2 (a, b), 3 (a, b, c) As for C.I. Reactive Yellow 1 —	4 (a, b), 5 (a, b), 6 (a, b, c) As for C.I. Reactive Yellow 1	1 (a, b, c), 2 (a, b), 3 (a, b, c) — — As for C.I. Reactive Red 4	**DYEING** Cellulose Nylon Silk Wool
Cellulose and silk: as for C.I. Reactive Yellow 1	Not recommended	Cellulose, nylon, silk and wool: as for C.I. Reactive Yellow 1	**PRINTING**
Cotton ISO / Nylon ISO / Silk ISO 5 / — / — — / — / — — / — / — — / — / — — / — / — — / — / — 6–7 / 6–7 / 6 6–7 / 6–7 / 6 2 / 4–5 / 3–4 4 / 5 / 5 — / — / — — / — / — — / — / — — / — / — 4–5 (5×10 0°C) / 4–5 (5×100°C) / 5 (95°C) 4–5 / 5 / 5	Cotton ISO 3–4 (yellower) — — — — 6 6–7 — 5 — — — — — 5 —	Cotton* ISO 3–4 (yellower) — — — — — 3–4 4 4–5 4 4–5 (yellower) 3–4 — — 4 (5×100°C) 3–4	**FASTNESS PROPERTIES** Fibre Method Alkali Burnt Gas Fumes Carbonising — Alkaline rinse Neutral rinse Decatising Light — ⅓—½ normal normal 2× normal Peroxide Bleach — Alteration Staining Perspiration — Alteration Staining Soda Boil — Alteration Staining Washing — Alteration Staining
Moderate white (pale depths only) 5 5 — — —	Good 5 5 Violet; on diln—scarlet Scarlet Bluer	Moderate white (pale dyeings) 2 (bluer, duller) 4–5 — — —	**OTHER PROPERTIES** Dischargeability Effect of Metals — Copper Iron Reactions in Substance H_2SO_4 conc. Dilute HCl Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: excellent	Solubility in water: very good; not sensitive to hard water Suitable for crease-resist finish (4–5)	Solubility in water: good *Fastness on nylon (ISO): light 4–5; on silk (ISO): light 4–5	**NOTES**

C.I. Reactive Red	9	10			11
CHEMICAL CLASS	Monoazo	Azo			Azo
REACTIVE SYSTEM	Monochlorotriazinyl	—			Dichlorotriazinyl
C.I. CONSTITUTION NO.	17910	—			—
HUE					
Daylight	Bright Yellowish Red	Bright Yellowish Red (nylon)			Bright Bluish Red
Artificial light (tungsten)	Unchanged	Yellower			Yellower
DYEING					
Cellulose	4 (a, b), 5 (a, b), 6 (a, b, c)	—			1 (a, b, c), 2 (a, b), 3 (a, b, c)
Nylon	—	Weak acid at 85–90°C; Na_2CO_3 added to effect fixation			—
Silk	—	—			—
Wool	—	—			As for C.I. Reactive Red 4
PRINTING	Not recommended	Nylon: acetic acid, sodium acetate, sodium chlorate + thickening; steamed Acetate and triacetate: urea, sodium chlorate + thickening; steamed			Cellulose, nylon, silk and wool: as for C.I. Reactive Yellow 1
FASTNESS PROPERTIES					
Fibre	Cotton	Nylon	Acetate	Triacetate	Cotton*
Method	ISO	ISO	ISO	ISO	ISO
Alkali	3 (bluer)	5	—	—	4 (bluer)
Burnt Gas Fumes	—	—	5	5	—
Carbonising — Alkaline rinse	—	4–5	—	—	—
Neutral rinse	—	—	—	—	—
Decatising	—	5	—	—	—
Light — ⅛–¼ normal	4	—	—	—	—
normal	4–5	5–6	5–6	5	4
2× normal	—	6	5–6	5–6	4
Peroxide Bleach — Alteration	5	—	—	—	4–5
Staining	—	—	—	—	4
Perspiration — Alteration	—	5	4 (bluer)	5	4–5
Staining	—	—	3	4	2
Soda Boil — Alteration	—	—	—	—	—
Staining	—	—	—	—	—
Washing — Alteration	4	5 (ISO 2)	5 (ISO 3)	5 (ISO 3)	4–5 (5×100°C)
Staining	—	—	4–5	5	3–4
OTHER PROPERTIES					
Dischargeability	Good	Very good			Coloured discharges (pale dyeings)
Effect of Metals — Copper	2 (duller)	4			2 (bluer, duller)
Iron	4–5	5			Unaffected
Reactions in Substance					
H_2SO_4 conc.	—	—			—
Dilute HCl	—	—			—
Dilute NaOH	—	—			—
NON-TEXTILE USAGE					
NOTES	Solubility in water: poor; not sensitive to hard water Suitable for crease-resist finish (4, bluer)				Solubility in water: very good *Fastness on nylon (ISO): light 4–5; on silk (ISO): light 5

12	13	14	C.I. Reactive Red
Monoazo	Monoazo	Azo (copper complex)	**CHEMICAL CLASS**
Monochlorotriazinyl	Monochlorotriazinyl	Monochlorotriazinyl	**REACTIVE SYSTEM**
18156	—	—	**C.I. CONSTITUTION NO.**
Bright Red	Bright Red	Bluish Red	**HUE** Daylight
—	Unchanged	Yellower	Artificial light (tungsten)
4 (a, b), 5 (a, b), 6 (a, b, c)	4 (a, b), 5 (a, b), 6 (a, b, c)	4 (a, b), 5 (a, b), 6 (a, b, c)	**DYEING** Cellulose
—	—	—	Nylon
—	—	—	Silk
As for C.I. Reactive Red 4	As for C.I. Reactive Red 4	—	Wool
Cellulose, nylon, silk and wool: as for C.I. Reactive Yellow 2	Nylon: as for C.I. Reactive Yellow 1	Cellulose and silk: as for C.I. Reactive Yellow 2 Suitable for printing on C.I. Azoic Coupling Components 2 and 5	**PRINTING**
Cotton ISO	Cotton ISO	Cotton* ISO	**FASTNESS PROPERTIES** Fibre Method
3–4 (bluer)	5	3–4 (bluer)	Alkali
—	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
4–5	3–4	—	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
5–6	4–5	6	normal
—	4–5	6–7	2× normal
5	4–5	3	Peroxide Bleach — Alteration
—	4–5	4–5	Staining
—	5	4–5	Perspiration — Alteration
—	4–5	3	Staining
—	—	—	Soda Boil — Alteration
—	—	—	Staining
5	4–5 (5×100°C)	4 (weaker, bluer) (5×100°C)	Washing — Alteration
—	4–5	4	Staining
Poor	Moderate white (pale dyeings)	To white (pale dyeings)	**OTHER PROPERTIES** Dischargeability
1 (duller)	2 (bluer, weaker)	Unaffected	Effect of Metals — Copper
4 (yellower)	4 (bluer, weaker, duller)	Unaffected	Iron
Bluer; on diln—no change	Violet; on diln—red	—	Reactions in Substance
Yellower	Unchanged	—	H_2SO_4 conc.
Browner	Yellower	—	Dilute HCl
			Dilute NaOH
			NON-TEXTILE USAGE
Solubility: very good; not sensitive to hard water Suitable for crease-resist finish (4–5)	Solubility in water: very good; not sensitive to hard water Suitable for crease-resist finish (3, bluer)	Solubility in water: very good Crease-resist finish: bluer (3); fastness to light slightly reduced *Fastness on nylon (ISO): light 6; on silk (ISO): light 6–7	**NOTES**

C.I. Reactive Red	15	16	17
CHEMICAL CLASS	Monoazo	Monoazo	Monoazo
REACTIVE SYSTEM	Monochlorotriazinyl	Monochlorotriazinyl	Trichloropyrimidinyl
C.I. CONSTITUTION NO.	—	—	18155
HUE			
Daylight	Bright Red	Yellowish Red	Bright Bluish Red
Artificial light (tungsten)	—	—	Much yellower, brighter
DYEING			
Cellulose	4 (a, b), 5 (a, b), 6 (a, b, c)	4 (a, b), 5 (a, b), 6 (a, b, c)	As for C.I. Reactive Yellow 8
Nylon	—	—	—
Silk	—	—	As for C.I. Reactive Yellow 8
Wool	As for C.I. Reactive Yellow 1	As for C.I. Reactive Yellow 1	
PRINTING	Cellulose, nylon, silk and wool: as for C.I. Reactive Yellow 2	Cellulose, silk and wool: as for C.I. Reactive Yellow 2	Cellulose, silk and wool: as for C.I. Reactive Yellow 8
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	3–4 (yellower, duller)	3 (bluer)	—
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	4–5	4–5	4–5
normal	5–6	5	5–6
2× normal	—	5–6	—
Peroxide Bleach — Alteration	4 (bluer)	4–5	4
Staining	—	—	5
Perspiration — Alteration	—	—	4–5
Staining	—	—	5
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	4–5	4–5	4–5 (95°C)
Staining	—	—	5
OTHER PROPERTIES			
Dischargeability	Good	Very good	
Effect of Metals — Copper	2–3 (bluer)	2 (bluer, weaker)	
Iron	5	4 (bluer, weaker)	
Reactions in Substance			
H_2SO_4 conc.	Bluer; on diln—unchanged	Red; on dilution—orange	
Dilute HCl	No change	Unchanged	
Dilute NaOH	Yellow to brown	Unchanged	
NON-TEXTILE USAGE			
NOTES	Solubility in water: very good; not sensitive to hard water Suitable for crease-resist finish (4)	Solubility in water: very good; not sensitive to hard water Suitable for crease-resist finish (3–4, bluer)	Solubility in water: good Crease-resist finish: trace lighter, light fastness slightly reduced

18	19	20	C.I. Reactive Red
Monoazo (copper complex) Trichloropyrimidinyl —	Monoazo Trichloropyrimidinyl —	Monoazo Tricholoropyrimidinyl —	**CHEMICAL CLASS** **REACTIVE SYSTEM** **C.I. CONSTITUTION NO.**
Dull Bluish Red Much yellower	Bright Yellowish Red Trace yellower, brighter	Bright Red Yellower, brighter	**HUE** Daylight Artificial light (tungsten)
As for C.I. Reactive Yellow 8 — As for C.I. Reactive Yellow 8	As for C.I. Reactive Yellow 8 — As for C.I. Reactive Yellow 8	As for C.I. Reactive Yellow 8 — As for C.I. Reactive Yellow 8	**DYEING** Cellulose Nylon Silk Wool
Cellulose, silk and wool: as for C.I. Reactive Yellow 8	Cellulose, silk and wool: as for C.I. Reactive Yellow 8	Cellulose, silk and wool: as for C.I. Reactive Yellow 8	**PRINTING**
Cotton ISO 4 — — — — 6 6–7 — 4–5 5 5 5 — — 5 (95°C) 5	Cotton ISO — — — — — 5–6 6 — 3–4 5 4–5 5 — — 4–5 (95°C) 5	Cotton ISO — — — — — 5 6 — 4–5 5 4–5 5 — — 4 (95°C) 5	**FASTNESS PROPERTIES** Fibre Method Alkali Burnt Gas Fumes Carbonising — Alkaline rinse Neutral rinse Decatising Light — $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Peroxide Bleach — Alteration Staining Perspiration — Alteration Staining Soda Boil — Alteration Staining Washing — Alteration Staining
2 — — — — —	4–5 — — — — —	2 — — — — —	**OTHER PROPERTIES** Dischargeability Effect of Metals — Copper Iron Reactions in Substance H_2SO_4 conc. Dilute HCl Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: very good Crease-resist finish: slightly bluer; light fastness unaffected	Solubility in water: very good Crease-resist finish: yellower; light fastness slightly reduced	Solubility in water: very good Crease-resist finish: trace bluer; light fastness slightly reduced	**NOTES**

C.I. Reactive Red	21	22	23
CHEMICAL CLASS	Monoazo	Monoazo	Monoazo (metal complex)
REACTIVE SYSTEM	Vinylsulphonyl	Vinylsulphonyl	Vinylsulphonyl
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Bright Bluish Red	Red	Bluish Pink→Bluish Red
Artificial light (tungsten)	—	—	—
DYEING			
Cellulose	Padded with urea+$NaHCO_3$, dried and fixed by steam or dry heat	As for C.I. Reactive Red 21	As for C.I. Reactive Red 21
Nylon	—	—	—
Silk	—	—	—
Wool	—	—	—
PRINTING	Cellulose: direct printing with $NaHCO_3$ and a neutral alginate thickener; fixed by neutral steaming	Cellulose: as for C.I. Reactive Red 21	Cellulose: as for C.I. Reactive Red 21
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	2 (bluer)	2 (bluer)	5
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	2–3	2–3	6–7
normal	3–4	3–4	7
2× normal	—	—	—
Peroxide Bleach — Alteration	—	—	—
Staining	—	—	—
Perspiration — Alteration	4–5	4–5	4–5
Staining	5	5	5
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	4–5 (75°C)	4–5 (75°C)	4–5 (75°C)
Staining	5	5	5
OTHER PROPERTIES			
Dischargeability	Dischargeable to white	Dischargeable to white	Dischargeable to white
Effect of Metals — Copper	—	—	—
Iron	—	—	—
Reactions in Substance			
H_2SO_4 conc.	—	—	—
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE			
NOTES	Solubility in water: good	Solubility in water: good	Solubility in water: good

24	25	26	C.I. Reactive Red
Azo	—	—	**CHEMICAL CLASS**
Monochlorotriazinyl	Trichloropyrimidinyl	Trichloropyrimidinyl	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Bluish Red	Bright Bluish Red	Bright Bluish Red	**HUE** Daylight
Yellower	—	—	Artificial light (tungsten)
—	As for C.I. Reactive Yellow 8	As for C.I. Reactive Yellow 8	**DYEING** Cellulose
—	—	—	Nylon
—	As for C.I. Reactive Yellow 8	As for C.I. Reactive Yellow 8	Silk
—			Wool
Cellulose, nylon, silk and wool: as for C.I. Reactive Yellow 2 Vigoureux printing	Cellulose, silk and wool: as for C.I. Reactive Yellow 8	Cellulose, silk and wool: as for C.I. Reactive Yellow 8	**PRINTING**
Cotton	Cotton	Cotton	**FASTNESS PROPERTIES** Fibre
ISO	ISO	ISO	Method
3–4 (bluer)	—	—	Alkali
—	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
4–5	4	5	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
5–6	4–5	6	normal
—	—	—	2× normal
4–5	4–5	4–5	Peroxide Bleach — Alteration
—	5	5	Staining
—	5	5	Perspiration — Alteration
—	5	5	Staining
—	—	—	Soda Boil — Alteration
—	—	—	Staining
5	5 (95°C)	5 (95°C)	Washing — Alteration
5	5	5	Staining
Poor			**OTHER PROPERTIES** Dischargeability
Considerably duller			Effect of Metals — Copper
Slightly yellower			Iron
Bluish red; on dilution—red			Reactions in Substance
Red			H_2SO_4 conc.
Scarlet			Dilute HCl
			Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: very good		Solubility in water: good Crease-resist finish: hue unaffected; light fastness somewhat reduced	**NOTES**

C.I. Reactive Red	27	28	29
CHEMICAL CLASS	Monoazo	Azo	Monoazo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Red	Red	Bright Bluish Red
Artificial light (tungsten)	—	Yellower	Yellower
DYEING			
Cellulose	Pad-steam or pad-bake	Not dyed	Jig- or pad-fixation method
Nylon	—	Dyed	—
Silk	—	Calcium chloride + ammonia at 50→90°C	—
Wool	—	Acetic acid; fixed by boiling. Na_2SO_4 aids levelling of pale dyeings*	—
PRINTING	Cellulose: alkaline paste with alginate or emulsion thickening; steamed or baked	Wool: printed with alginate thickening; steamed	Cellulose: steaming, dry heat, high-temperature steaming, flash-age (2-phase) and wet development processes Silk and wool: suitable
FASTNESS PROPERTIES			
Fibre	Cotton	Wool / Silk	Cotton
Method	ISO	ISO / ISO	ISO
Alkali	—	3–4 / —	2 (bluer, duller)
Burnt Gas Fumes	—	— / —	—
Carbonising — Alkaline rinse	—	4–5 / —	—
Neutral rinse	—	4–5 / —	—
Decatising	—	4–5 / —	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	4	4–5 / 4	—
normal	4–5	5–6 / 4–5	4–5*
2× normal	4–5	6 / 5–6	5
Peroxide Bleach — Alteration	2–3	4–5 / —	4–5
Staining	3–4	5 / —	5
Perspiration — Alteration	—	5 / 5	4–5 (bluer)
Staining	—	5 / 5	4
Soda Boil — Alteration	—	— / —	4
Staining	—	— / —	4
Washing — Alteration	5	4–5 (60°C) / 5 (60°C)	4–5 (bluer) (5×100°C)
Staining	5	5 / 5	5
OTHER PROPERTIES			
Dischargeability	Poor (alkaline)	4 unexposed (3 on silk); 2 exposed	Moderate at std depth†
Effect of Metals — Copper	—	4–5	1 (bluer)
Iron	—	4–5	5
Reactions in Substance			
H_2SO_4 conc.	Red	—	—
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE			
NOTES	Suitable for crease-resist finishes	Solubility in water: >100 g/l at 40–50°C *May be aftertreated with ammonia for deep dyeings on wool or chlorinated wool	Solubility in water: 190 g/l at 50°C Crease-resist finishes: hue slightly affected; light fastness 3–4 Low substantivity. Fastness on viscose slightly better than on cotton *Fastness on silk and wool: light 6 †Good at $\frac{1}{25}$ std

30	31	32	C.I. Reactive Red
Monoazo	Azo	Azo	**CHEMICAL CLASS**
—	—	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Bluish Red	Bluish Red	Bluish Red	**HUE**
—	Yellower	Yellower	Daylight
			Artificial light (tungsten)
—	Batchwise and continuous methods	Jig- or pad-fixation method	**DYEING**
Acetic acid at 85–100°C; soda ash added for fixation	—	—	Cellulose
—	—	—	Nylon
—	—	—	Silk
			Wool
Nylon: with acetic acid, sodium acetate and sodium chlorate; steamed at atmospheric pressure*	Cellulose: as for C.I. Reactive Red 29	Cellulose: as for C.I. Reactive Red 29	**PRINTING**
Nylon ISO / Acetate ISO / Triacetate ISO	Cotton ISO	Cotton ISO	**FASTNESS PROPERTIES**
— / — / —	4–5 (bluer)	4	Fibre
4–5 / 4 (yellower) / 2	5	4	Method
— / — / —	—	—	Alkali
— / — / —	—	—	Burnt Gas Fumes
— / — / —	—	—	Carbonising — Alkaline rinse
			Neutral rinse
			Decatising
— / — / —	4	—	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
4 / 3 / 3	4–5	6–7	normal
4 / 3 / 3	4–5	6–7	2× normal
— / — / —	4	3	Peroxide Bleach — Alteration
— / — / —	4–5	4–5	Staining
5 / 4–5 / 5	4	4 (bluer)	Perspiration — Alteration
— / 5 / 5	3–4	4	Staining
— / — / —	3–4	3 (weaker, yellower)	Soda Boil — Alteration
— / — / —	4	3	Staining
5 (ISO 3) / 4–5 (ISO 3) / 5 (ISO 3)	4–5 (ISO 3)	4–5 (ISO 5)	Washing — Alteration
5 / 4–5 / 5	5	4–5	Staining
Fair	—	To white at low depths	**OTHER PROPERTIES**
—	1 (bluer)	4	Dischargeability
—	4–5 (yellower)	4–5 (duller)	Effect of Metals — Copper
			Iron
—	—	—	Reactions in Substance
—	—	—	H_2SO_4 conc.
—	—	—	Dilute HCl
			Dilute NaOH
			NON-TEXTILE USAGE
*Printing of acetate: with urea; fixed by steaming Printing of triacetate: with urea and steamed under pressure; if a carrier is present in the paste, steaming may be at atmospheric pressure	Solubility in water: 200 g/l at 50°C Suitable for crease-resist finishes	Solubility in water: 50 g/l at 50°C Suitable for crease-resist finishes	**NOTES**

C.I. Reactive Red	33	34	35
CHEMICAL CLASS	Azo	Monoazo	Monoazo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Yellowish Red	Bright Red	Bright Bluish Red
Artificial light (tungsten)	Yellower	—	Slightly yellower
DYEING			
Cellulose	Pad(alkali)-steam or -batch	Suitable	Pad-batch method
Nylon	Formic acid at the boil	—	—
Silk	Not of interest (poor build-up)	—	—
Wool	pH 5·5 with special assistants, at the boil	—	—
PRINTING	Cellulose, silk and wool: as for C.I. Reactive Yellow 2 Unsuitable for printing on nylon		
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	5	3	2 (yellower, duller)
Burnt Gas Fumes	4–5	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	4	—
normal	4	4–5	4
2× normal	4	5	—
Peroxide Bleach — Alteration	4	—	—
Staining	5	—	—
Perspiration — Alteration	5	5	5
Staining	4–5	5	5
Soda Boil — Alteration	4–5	—	—
Staining	4	—	—
Washing — Alteration	4–5 (ISO 3, 4 or 5)	5	3 (bluer) (95°C)
Staining	4–5	5	5
OTHER PROPERTIES			
Dischargeability	—	White and coloured discharges	White and coloured discharges
Effect of Metals — Copper	2 (bluer)	—	—
Iron	5	—	—
Reactions in Substance			
H_2SO_4 conc.	—	—	—
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE			
NOTES	Solubility in water: 120 g/l at 90°C Suitable for crease-resist finishes	Suitable for PVC coating	Solubility in water: good Suitable for PVC coating Crease-resist finishes: hue unchanged or trace duller; usually a slight adverse effect on light fastness

35:1	36	37	C.I. Reactive Red
Monoazo	Monoazo	Monoazo	**CHEMICAL CLASS**
—	—	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Bluish Red	Bluish Red	Bluish Red	**HUE**
—	—	—	Daylight
			Artificial light (tungsten)
—	Pad-fixation methods (especially pad-batch)	Exhaustion, pad-batch, pad-jig, pad-bake and pad-steam processes	**DYEING**
—	—	—	Cellulose
—	—	—	Nylon
—	—	—	Silk
—	—	—	Wool
Cellulose: with Na_2CO_3 (or NaOH); fixation by steam or dry heat Print paste has good stability	Cellulose: suitable		**PRINTING**
Cellulose ISO	Cotton ISO	Cotton ISO	**FASTNESS PROPERTIES** Fibre Method
3–4 (yellower)	2 (yellower)	3–4	Alkali
—	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
3	3–4	6	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
3–4	4	6–7	normal
4	4–5	—	2× normal
—	—	2	Peroxide Bleach — Alteration
—	—	4–5	Staining
5	5	5	Perspiration — Alteration
5	5	5	Staining
—	—	2	Soda Boil — Alteration
—	—	4–5	Staining
4–5 (75°C)	4–5 (95°C)	5 (60°C)	Washing — Alteration
5	5	5	Staining
White and coloured discharges	Good		**OTHER PROPERTIES** Dischargeability
—	—		**Effect of Metals** — Copper
—	—		Iron
—	—		Reactions in Substance
—	—		H_2SO_4 conc.
—	—		Dilute HCl
—	—		Dilute NaOH
			NON-TEXTILE USAGE
Suitable for PVC coating	Solubility in water: 75 g/l Suitable for crease-resist finishes	Sensitive to hard water Suitable for crease-resist finishes (bluer, with slightly reduced light fastness) Effect threads: acetate unstained, nylon slightly stained, polyester unstained	**NOTES**

C.I. Reactive Red	38	39	40	
CHEMICAL CLASS	Monoazo	Monoazo	Monoazo	
REACTIVE SYSTEM	—	—	—	
C.I. CONSTITUTION NO.	—	—	—	
HUE				
Daylight	Red	Red	Bluish Red	
Artificial light (tungsten)	—	Yellower	—	
DYEING				
Cellulose	Exhaustion and padding processes	Pad fixation processes	Exhaustion, pad-batch, pad-jig, pad-thermofix and pad-steam methods	
Nylon	—	—	—	
Silk	—	—	—	
Wool	—	—	—	
PRINTING	Cellulose: suitable		Cellulose: steaming, pad-steam, wet development and dry heat methods Paste is stable for >28 days at 20°C Suitable for overprinting with caustic alkali	
FASTNESS PROPERTIES				
Fibre	Cotton	Cotton	Cotton (dyed)	Cotton (printed)
Method	ISO	ISO	ISO	ISO
Alkali	2	2 (duller)	3–4 (yellower)	—
Burnt Gas Fumes	—	—	—	—
Carbonising — Alkaline rinse	—	—	—	—
Neutral rinse	—	—	—	—
Decatising	—	—	—	—
Light — ⅓–½ normal	3–4	4–5	5	4
normal	4–5	5–6	5–6	4–5
2× normal	—	—	—	5
Peroxide Bleach — Alteration	2	—	2	4–5 (wash)
Staining	5	—	4	4–5
Perspiration — Alteration	5	4–5	4–5	4–5
Staining	5	—	5	2–3
Soda Boil — Alteration	3	2–3 (bluer)	2	3
Staining	4	4–5	5	3–4
Washing — Alteration	5 (60°C)	3–4 (95°C)	4 (60°C)	4
Staining	5	5	4–5	4–5
OTHER PROPERTIES				
Dischargeability		Good	Dischargeable to white at low depths	
Effect of Metals — Copper		—	—	
Iron		—	—	
Reactions in Substance				
H_2SO_4 conc.		—	—	
Dilute HCl		—	—	
Dilute NaOH		—	—	
NON-TEXTILE USAGE				
NOTES	Sensitive to hard water Suitable for crease-resist finishes Effect threads: acetate slightly stained, triacetate unstained, nylon slightly stained, polyester unstained	Solubility in water: 130 g/l at 60°C Suitable for crease-resist finishes (bluer) Suitable for rubberising, coating with PVC, etc	Effect threads: acetate and nylon slightly stained, triacetate and polyester unstained Crease-resist finishes: bluer Suitable for PVC coating	

41	42	43	C.I. Reactive Red
Monoazo	Monoazo	Monoazo	**CHEMICAL CLASS**
Chloroquinoxaline	—	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Bright Red	Bright Bluish Red	Yellowish Red	**HUE** Daylight
Yellower	Much yellower	Yellower	Artificial light (tungsten)
	Pad-thermofix, pad-jig, single pad-steam and exhaustion methods	Batchwise (low salt content) and pad (alkali)-batch (cold) processes	**DYEING** Cellulose
	—	—	Nylon
	—	—	Silk
	—	Suitable	Wool
	Wool: steam fixation	Wool: suitable; steam fixation	**PRINTING**
Cotton AATCC	Cotton ISO	Cotton ISO	**FASTNESS PROPERTIES** Fibre Method
—	2 (bluer)	4–5 (bluer)	Alkali
—	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
4–5	4–5	3–4	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
5	5	4–5	normal
5	—	—	2× normal
—	4–5	4–5	Peroxide Bleach — Alteration
—	5	3–4	Staining
5	4 (bluer)	4–5 (brighter)	Perspiration — Alteration
3	5	3–4	Staining
—	4 (bluer)	4	Soda Boil — Alteration
—	4–5	3	Staining
3–4 (weaker)	5	4–5	Washing — Alteration
4	5	3–4	Staining
—	Not dischargeable	Not dischargeable	**OTHER PROPERTIES** Dischargeability
—	Much bluer	2 (bluer, duller)	Effect of Metals — Copper
—	4–5	4–5	Iron
Red; on diln—red	Yellowish red; on diln—bluish red	—	Reactions in Substance H_2SO_4 conc.
—	Bluish red	—	Dilute HCl
—	Scarlet	—	Dilute NaOH
			NON-TEXTILE USAGE
	Solubility in water: very good. Not sensitive to hard water	Solubility in water: 140 g/l at 20°C	**NOTES**

C.I. Reactive Red	44	45	46
CHEMICAL CLASS	Azo	Azo	Azo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Bluish Red (nylon)	Bright Bluish Red	Bright Bluish Red
Artificial light (tungsten)	Yellower	Yellower	Yellower
DYEING			
Cellulose	—	Pad-fix, -jig, -steam; viscose by exhaustion	Pad-steam, -fix, -batch, -roll, -jig Exhaustion dyeing on viscose only
Nylon	Acid for exhaustion; bath then made alk. for fixation	—	—
Silk	—	—	—
Wool	—	Exhaustion	—
PRINTING	Nylon: with acetic acid, sodium acetate and sodium chlorate Acetate and triacetate*	Cellulose: steam, thermofix or flash-age Silk and wool: steam fixation	Cellulose: steam, thermofix or flash-age processes Silk and wool: steam
FASTNESS PROPERTIES			
Fibre	Nylon	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	5	3–4	4 (bluer)
Burnt Gas Fumes	5	—	—
Carbonising — Alkaline rinse	5	—	—
Neutral rinse	5	—	—
Decatising	5	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	4	6
normal	5	5	6
2× normal	5–6	—	—
Peroxide Bleach — Alteration	5	4	2
Staining	5	—	—
Perspiration — Alteration	4–5 (duller)	4 (alk)	—
Staining	3–4	4–5	—
Soda Boil — Alteration	—	4	—
Staining	—	4	—
Washing — Alteration	4–5 (ISO 3)	4–5	5
Staining	5	5	—
OTHER PROPERTIES			
Dischargeability	—	Weak dyeings are dischargeable	Not dischargeable
Effect of Metals — Copper	Dyeing nylon: 4–5 (duller)	—	4
Iron	Dyeing nylon: 4–5 (duller)	—	4–5
Reactions in Substance		(On the fibre)	
H_2SO_4 conc.	—	Reddish violet; on diln—no change	Bluish red; on diln—violet
Dilute HCl	—	Yellowish red	Orange
Dilute NaOH	—	Yellowish brown	No change
NON-TEXTILE USAGE			
NOTES	Acetate and triacetate may be dyed by processes used for conventional disperse dyes *Printing of acetate: with urea; fixed by steaming Printing of triacetate: with urea; steamed under pressure (or at atmospheric pressure if a carrier is present in the print paste)	Solubility in water: 150 g/l at 60°C Not sensitive to hard water Effect threads: nylon heavily stained, acetate, acrylic and polyester unstained Suitable for crease-resist finishes; hue weaker (4), bluer	Solubility in water: 45 g/l; not sensitive to hard water Suitable for crease-resist finishes; hue weaker (3–4) and bluer

47	48	49	C.I. Reactive Red
Azo (metallised)	Azo (metallised)	Monoazo	**CHEMICAL CLASS**
—	—	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Bordeaux	Dull Yellowish Red	Bordeaux	**HUE**
—	—	—	Daylight
			Artificial light (tungsten)
As for C.I. Reactive Yellow 30*	As for C.I. Reactive Yellow 30*		**DYEING**
—	—		Cellulose
—	—		Nylon
—	—		Silk
			Wool
Cellulose: as for C.I. Reactive Yellow 30	Cellulose: as for C.I. Reactive Yellow 30	Cellulose: direct and discharge styles	**PRINTING**
Cotton	Cotton	Cotton	**FASTNESS PROPERTIES**
ISO	ISO	ISO	Fibre
			Method
—	—	3–4 (bluer)	Alkali
—	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
4	6–7	5–6	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
4–5	6–7	6	normal
—	—	6–7	2× normal
4	4	—	Peroxide Bleach — Alteration
5	5	—	Staining
5 (alk)	5	5	Perspiration — Alteration
5	5	5	Staining
—	—	—	Soda Boil — Alteration
—	—	—	Staining
4–5	4–5	4–5 (95°C)	Washing — Alteration
5	5	5	Staining
—	—	Good (pale dyeings only)	**OTHER PROPERTIES**
—	—	—	Dischargeability
—	—	—	Effect of Metals — Copper
			Iron
Orange brown; on diln—red	Dull bluish red; on diln—brownish orange	—	Reactions in Substance
—	—	—	H_2SO_4 conc.
Weaker	Weaker	—	Dilute HCl
			Dilute NaOH
			NON-TEXTILE USAGE
*This dye does not react directly with the fibre, but requires the use of a fixing agent	Solubility in water: 100 g/l Suitable for crease-resist finishes *This dye does not react directly with the fibre, but requires the use of a fixing agent	Suitable for PVC coating	**NOTES**

C.I. Reactive Red	50	51	52
CHEMICAL CLASS	Monoazo	Monoazo	Azo
REACTIVE SYSTEM	—	—	Dichloropyridazonyl
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Dull Bluish Red	Red	Bluish Red
Artificial light (tungsten)	Yellower	—	—
DYEING			
Cellulose	Exhaustion (jigger or winch) or two-bath pad-steam process	—	Padded with alkali; fixed by steaming, thermofix, batching or pad-roll process
Nylon	—	Neutral	—
Silk	—	—	—
Wool	—	Neutral or weak acid	—
PRINTING		Wool: direct Nylon: direct and discharge styles	Direct on cotton and viscose
FASTNESS PROPERTIES			
Fibre	Mercerised cotton	Wool / Nylon	Cotton
Method	ISO	ISO / ISO	ISO
Alkali	4–5	4 / 5	—
Burnt Gas Fumes	—	— / —	—
Carbonising — Alkaline rinse	—	4–5 / 5	—
Neutral rinse	—	4–5 / 5	—
Decatising	—	4–5 (severe) / 4–5 (severe)	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	5–6	5–6 / 5–6	4
normal	7	6 / 6	4–5
2× normal	—	6 / 6	—
Peroxide Bleach — Alteration	—	— / —	—
Staining	—	— / —	—
Perspiration — Alteration	4 (bluer)	5 (acid) / 4–5 (acid)	4
Staining	5 (acid or alk)	4–5 / 4	5
Soda Boil — Alteration	—	— / —	—
Staining	—	— / —	—
Washing — Alteration	4 (95°C)	4 (60°C) / 5 (60°C)	4 (Test 4)
Staining	5	4 / 5	5
OTHER PROPERTIES			
Dischargeability	Good	Good	Good
Effect of Metals — Copper	—	3 (weaker)	—
Iron	—	3–4 (weaker)	—
Reactions in Substance			
H_2SO_4 conc.	—	—	Red
Dilute HCl	—	—	—
Dilute NaOH	—	—	Brown
NON-TEXTILE USAGE			
NOTES	Solubility in water: 70 g/l at 100°C Effect threads: acetate stained, nylon slightly stained, acrylic, polyester and triacetate unstained Suitable for crease-resist finishes		Solubility in water: 70 g/l at 20°C, 150 g/l at 90°C

53	54	55	C.I. Reactive Red
Azo	Azo	Monoazo	**CHEMICAL CLASS**
—	Acryloylamido	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Bluish Red	Yellowish Red	Bluish Red	**HUE** Daylight
Redder	—	Yellower	Artificial light (tungsten)
Thermofix, pad-steam and pad-batch processes	Padded with alkali; fixed by steaming, thermofix, batching or pad-roll processes	Exhaustion dyeing	**DYEING** Cellulose
—	—	—	Nylon
—	—	—	Silk
—	—	—	Wool
Cellulose: fixation by steaming or hot air Discharge styles			**PRINTING**
Cotton ISO	Cotton ISO	Cotton ISO	**FASTNESS PROPERTIES** Fibre Method
— 4 — — —	— — — — —	4 — — — —	Alkali Burnt Gas Fumes Carbonising — Alkaline rinse Neutral rinse Decatising
4–5 5 —	4–5 5 —	6 7 —	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal
— — 4–5 4–5	— — 4–5 4–5	— — 5 5	Peroxide Bleach — Alteration Staining Perspiration — Alteration Staining
— — 4–5 (Test 4) 5	— — 4–5 (Test 4) 5	— — 5 (95°C) 5	Soda Boil — Alteration Staining Washing — Alteration Staining
Good — — Bluish Red — Yellowish brown	Good — — Bluish red — Yellowish orange	2 — — — — —	**OTHER PROPERTIES** Dischargeability Effect of Metals — Copper Iron Reactions in Substance H_2SO_4 conc. Dilute HCl Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: 50 g/l at 70°C, 150 g/l at 90°C Suitable for crease-resist finishes, also for PVC coating and vulcanising	Solubility in water: 20 g/l at 20°C, 120 g/l at 90°C Suitable for crease-resist finishes	Solubility in water: 90 g/l at 30°C, 100 g/l at 90°C Poor coverage of dead cotton; satisfactory coverage of barré viscose Suitable for crease-resist finishes	**NOTES**

C.I. Reactive Red	56	57	58
CHEMICAL CLASS	Azo		Azo
REACTIVE SYSTEM	—		—
C.I. CONSTITUTION NO.	—		—
HUE			
Daylight	Bluish Red		Bluish Red
Artificial light (tungsten)	Yellower, brighter		Yellower
DYEING			
Cellulose	Exhaustion methods	This C.I. Generic Name is discontinued. The dyes formerly listed under it now appear under C.I. Reactive Red 55	4 (a, b), 5 (a, b), 6 (a, b, c)
Nylon	—		—
Silk	—		—
Wool	—		—
PRINTING			
FASTNESS PROPERTIES			
Fibre	Cotton		Cotton
Method	ISO		ISO
Alkali	1–2 (bluer)		3–4
Burnt Gas Fumes	—		5
Carbonising — Alkaline rinse	—		—
Neutral rinse	—		—
Decatising	—		—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	4		—
normal	5		4
2× normal	—		4
Peroxide Bleach — Alteration	4		4
Staining	5		4–5
Perspiration — Alteration	4		4
Staining	5		3–4
Soda Boil — Alteration	4		3
Staining	4		4
Washing — Alteration	4 (Test 4)		3–4 (ISO 5)
Staining	4		4–5
OTHER PROPERTIES			
Dischargeability	2 (neutral or alkaline)		Moderate–poor
Effect of Metals — Copper	—		2
Iron	—		5
Reactions in Substance			
H_2SO_4 conc.	—		—
Dilute HCl	—		—
Dilute NaOH	—		—
NON-TEXTILE USAGE			
NOTES	Solubility in water: 100 g/l. Good stability in hard water Good washing off Moderate coverage of dead cotton; good coverage of barré viscose Suitable for resin finishing, rubberising and coating with PVC		Solubility in water: 100 g/l at 50°C Suitable for crease-resist finishes; there is usually a slight change of hue

59	60	61	C.I. Reactive Red
Azo	Azo	Azo	**CHEMICAL CLASS**
—	—	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Yellowish Red	Bright Bluish Red	Red	**HUE** Daylight
Yellower	Yellower	Yellower	Artificial light (tungsten)
Continuous or semi-continuous methods (pad-fix); low substantivity	Dyed	Dyed	**DYEING** Cellulose
—	—	—	Nylon
—	—	—	Silk
—	Weak acid	Weak acid	Wool
	Cellulose: with Na_2CO_3; fixed by steaming	Cellulose: with Na_2CO_3; fixed by steaming	**PRINTING**
Cotton ISO	Cellulose ISO	Cellulose ISO	**FASTNESS PROPERTIES** Fibre Method
3	3 (bluer)	2–3 (duller)	Alkali
4	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
—	6	4–5	Light — $\frac{1}{3}$—$\frac{1}{2}$ normal
4	6	5	normal
4	—	—	2× normal
3–4	3	3	Peroxide Bleach — Alteration
5	—	—	Staining
5	—	—	Perspiration — Alteration
4–5	—	—	Staining
3–4	—	—	Soda Boil — Alteration
5	—	—	Staining
4–5 (ISO 5)	4–5 (60°C)	4–5 (60°C)	Washing — Alteration
5	—	—	Staining
Moderate–good	Poor (neutral and alkaline)	Poor (neutral and alkaline)	**OTHER PROPERTIES** Dischargeability
2	Unchanged	Slightly weaker	Effect of Metals — Copper
4	Unchanged	Slightly weaker	Iron
—	Violet; on diln—orange+ppt	Red	Reactions in Substance H_2SO_4 conc.
—	Orange	Red	Dilute HCl
—	Unchanged	Garnet	Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: 200 g/l at 50°C Suitable for crease-resist finishes (some change in hue)	Solubility in water: very good Suitable for crease-resist finishes (bluer)	Solubility in water: good Suitable for crease-resist finishes	**NOTES**

C.I. Reactive Red	62	63	64
CHEMICAL CLASS	Azo	Monoazo	Monoazo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Bright Yellowish red	Red	Bordeaux
Artificial light (tungsten)	Yellower	Yellower	Redder
DYEING			
Cellulose	Dyed	Padded with $NaHCO_3$ and urea; fixed by steaming or dry heat*	Padded with $NaHCO_3$ and urea; fixed by steaming or dry heat
Nylon	—	—	—
Silk	—	—	—
Wool	Weak acid	—	—
PRINTING	Cellulose: with Na_2CO_3; fixed by steaming	Cellulose: with $NaHCO_3$ and a neutral alginate thickener; fixed by neutral steaming Discharge styles	Cellulose: with $NaHCO_3$ and a neutral alginate thickener; fixed by neutral steaming Also discharge styles
FASTNESS PROPERTIES			
Fibre	Cellulose	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	4	4 (bluer)	4 (bluer)
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	3–4	3–4	4
normal	4–5	4	4–5
2× normal	—	4–5	5
Peroxide Bleach — Alteration	3–4	—	—
Staining	—	—	—
Perspiration — Alteration	—	4–5	4–5 (acid)
Staining	—	5	4
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	4–5 (60°C)	3–4 (95°C)	4 (95°C)
Staining	—	5	5
OTHER PROPERTIES			
Dischargeability	Poor (neutral and alkaline)	Good	Moderate
Effect of Metals — Copper	Slightly bluer	—	—
Iron	Slightly bluer and duller	—	—
Reactions in Substance			
H_2SO_4 conc.	Bluish red	—	—
Dilute HCl	Unchanged	—	—
Dilute NaOH	Deeper red	—	—
NON-TEXTILE USAGE			
NOTES	Solubility in water: good Suitable for crease-resist finishes	Solubility in water: 100 g/l at 100°C Effect threads: nylon stained, acetate and triacetate slightly stained, polyester and polyacrylonitrile unstained Suitable for crease-resist finishes (slightly bluer; slight loss of light fastness) *Exhaustion processes unsuitable	Suitable for PVC coating

65	66	67	C.I. Reactive Red
Azo	Azo	Monoazo	CHEMICAL CLASS
—	—	—	REACTIVE SYSTEM
—	—	—	C.I. CONSTITUTION NO.
Bluish Red	Bluish Red	Bright Red	HUE Daylight
Yellower	Yellower	Yellower	Artificial light (tungsten)
—	—	Pad-batch (cold) or exhaustion process	DYEING Cellulose
—	—	—	Nylon
—	—	—	Silk
Exhaustion dyeing	Exhaustion dyeing	—	Wool
Wool and silk	On wool and silk, also unions		PRINTING
Wool ISO	Wool ISO	Cotton ISO	FASTNESS PROPERTIES Fibre Method
—	—	2 (bluer)	Alkali
—	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
5–6	4–5	4–5	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
6	5–6	4–5	normal
6–7	6–7	5	2× normal
—	—	2–3 (bluer)	Peroxide Bleach — Alteration
—	—	5	Staining
—	—	4, 4 (acid, alk)	Perspiration — Alteration
—	—	4, 4–5	Staining
—	—	2–3 (bluer)	Soda Boil — Alteration
—	—	4	Staining
4 (bluer) (Test 3)	4–5 (Test 3)	4–5 (95°C)	Washing — Alteration
5	5	5	Staining
Very good	Very good	Good	OTHER PROPERTIES Dischargeability
5	5	—	Effect of Metals — Copper
5		—	Iron
Bluish red*	Yellowish red*	—	Reactions in Substance H_2SO_4 conc.
Bluish red	Reddish violet	—	Dilute HCl
Bluish red	Reddish violet	—	Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: good *Dilute H_2SO_4—red–violet	Solubility in water: very good Good wet fastness on chlorinated wool *Dilute H_2SO_4—reddish violet	Suitable for PVC coating Crease-resist finishes: hue somewhat bluer; light fastness somewhat reduced	NOTES

C.I. Reactive Red	68	69	70
CHEMICAL CLASS	Monoazo	Monoazo	Monoazo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Red	Red	Red
Artificial light (tungsten)	Yellower, purer	Yellower	Yellower
DYEING			
Cellulose	Exhaustion dyeing (Na_2SO_4 or NaCl + Na_2CO_3, Na_3PO_4 or NaOH)	As for C.I. Reactive Yellow 40	As for C.I. Reactive Yellow 40
Nylon	—	As for C.I. Reactive Yellow 40	As for C.I. Reactive Yellow 40
Silk	—		
Wool	—		
PRINTING		Cellulose: as for C.I. Reactive Yellow 40	Cellulose: as for C.I. Reactive Yellow 40
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	2 (redder, duller)	—	—
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	5	4–5
normal	3–4	5–6	4–5
2× normal	—	—	—
Peroxide Bleach — Alteration	3 (redder, duller)	4	4–5
Staining	3–4	4–5	5
Perspiration — Alteration	4–5	—	—
Staining	5	—	—
Soda Boil — Alteration	3–4	—	—
Staining	4	—	—
Washing — Alteration	4 (Test 4)	4–5	4–5
Staining	4–5	4–5	5
OTHER PROPERTIES			
Dischargeability	4 (neutral or alkaline)	Not dischargeable	Not dischargeable
Effect of Metals — Copper	—	Unaffected	Unaffected
Iron	—	Unaffected	Unaffected
Reactions in Substance			
H_2SO_4 conc.	—	Blue	Blue
Dilute HCl	—	Yellower	Redder
Dilute NaOH	—	Browner	Brown
NON-TEXTILE USAGE			
NOTES	Solubility in water: 80, 90 and 100 g/l at 40, 60 and 90°C, respectively. Good stability in hard water. Good washing off. Suitable (free from Cu and Mn) for vulcanising. Suitable for PVC coating and resin finishing Moderate coverage of dead cotton and barré viscose	Solubility in water: good Used chiefly for printing cellulose	Solubility in water: good Used chiefly for printing cellulose

71	72	73	C.I. Reactive Red
Monoazo	Monoazo (chromium complex)	Azo	CHEMICAL CLASS
—	—	—	REACTIVE SYSTEM
—	—	—	C.I. CONSTITUTION NO.
Bluish Red	Red	Bright Bluish Red	HUE Daylight
Brighter	Yellower	—	Artificial light (tungsten)
As for C.I. Reactive Yellow 40	—	1 (a, b, c), 2 (a, b), 3 (a, b, c)	DYEING Cellulose
As for C.I. Reactive Yellow 40	—	—	Nylon
As for C.I. Reactive Yellow 40	—	—	Silk
	Ammonium acetate (or sulphate)+ acetic acid (pH 6·0–6·5) at 70°C→boil	—	Wool
Cellulose: as for C.I. Reactive Yellow 40		Cellulose, nylon, silk and wool	PRINTING
Cotton ISO	Wool ISO	Cotton ISO	FASTNESS PROPERTIES Fibre Method
— —	— —	— —	Alkali Burnt Gas Fumes
— —	4–5 (yellower) —	— —	Carbonising — Alkaline rinse Neutral rinse
—	4–5 (yellower)	—	Decatising
3–4 4 —	— 5–6 6–7	— 4–5 —	Light — $\frac{1}{3}$—$\frac{1}{2}$ normal normal 2× normal
4–5 5	4–5 —	— —	Peroxide Bleach — Alteration Staining
— —	5 5	4–5 —	Perspiration — Alteration Staining
— —	— —	— —	Soda Boil — Alteration Staining
4–5 5	4–5 (ISO 3) 4–5	4 (5×95°C) —	Washing — Alteration Staining
Not dischargeable Unaffected Unaffected	— 4 (yellower, duller) 4–5 (duller)	Moderate — —	OTHER PROPERTIES Dischargeability Effect of Metals — Copper Iron
Brown Redder Redder	— — —	— — —	Reactions in Substance H_2SO_4 conc. Dilute HCl Dilute NaOH
	Clothing leathers		NON-TEXTILE USAGE
Solubility in water: good Used chiefly for printing cellulose	Solubility in water: 40 g/l at 90°C Staining of effect threads: acetate 4–5, cotton 3–4, nylon 1, polyester 4, silk 2	Solubility in water: very good	NOTES

C.I. Reactive Red	74	75	76
CHEMICAL CLASS	Azo	Azo	Azo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Bright Bluish Pink	Bright Bluish Red	Bright Bluish Red
Artificial light (tungsten)	—	—	—
DYEING			
Cellulose	1 (a, b, c), 2 (a, b), 3 (a, b, c)	1 (a, b, c), 2 (a, b), 3 (a, b, c)	Padding, continuous and exhaustion methods
Nylon	—	—	Suitable
Silk	—	—	
Wool	—	—	
PRINTING	Cellulose, nylon, silk and wool	Cellulose, nylon, silk and wool	Cellulose, nylon, silk and wool: direct printing
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	—	—	—
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	—	—
normal	4–5	4–5	4
2× normal	—	—	—
Peroxide Bleach — Alteration	—	—	—
Staining	—	—	—
Perspiration — Alteration	4–5	4–5	4
Staining	—	—	—
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	4 (5×95°C)	4–5 (5×95°C)	3 (5×95°C)
Staining	—	—	—
OTHER PROPERTIES			
Dischargeability	Moderate	Poor	Poor
Effect of Metals — Copper	—	—	—
Iron	—	—	—
Reactions in Substance			
H_2SO_4 conc.	—	—	—
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE			
NOTES	Solubility in water: good	Solubility in water: very good	Solubility in water: good

77	78	79	C.I. Reactive Red
Azo	Monoazo	Monoazo	**CHEMICAL CLASS**
—	—	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Bright Bluish Red	Bright Yellowish Red	Bluish Red	**HUE** Daylight
—	Brighter	Lighter, yellower	Artificial light (tungsten)
Padding, continuous and exhaustion methods	—	—	**DYEING** Cellulose
	—	—	Nylon
Suitable	—	—	Silk
	—	—	Wool
Cellulose, nylon, silk and wool: direct printing	Silk and wool	Cellulose: steaming, high-temperature steaming, baking, flash-age (two-phase) and wet-development processes Suitable for printing on cellulose-polyester unions but not on nylon	**PRINTING**
Cotton ISO	Wool ISO	Cotton ISO	**FASTNESS PROPERTIES** Fibre Method
—	3–4 (bluer)	3 (bluer)	Alkali
—	—	5	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
—	4–5	—	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
4–5	5	4–5	normal
—	6	5	2× normal
—	3–4 (bluer)	—	Peroxide Bleach — Alteration
—	4–5	—	Staining
4	—	4–5 (yellower)	Perspiration — Alteration
—	—	5	Staining
—	—	—	Soda Boil — Alteration
—	—	—	Staining
3–4 (5 × 95°C)	4 (bluer) (ISO 3)	4–5 (ISO 4)	Washing — Alteration
—	5	5	Staining
Poor	Very good		**OTHER PROPERTIES** Dischargeability
—	4 (bluer, duller)		Effect of Metals — Copper
—	4–5		Iron
—	Bluish red*		Reactions in Substance H_2SO_4 conc.
—	Yellowish red		Dilute HCl
—	Brownish orange		Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: good	Solubility in water: very good *On dilution—yellowish red	Very good washing off. Print paste is stable for more than 28 days Resin treatment (cotton): M/F 5	**NOTES**

C.I. Reactive Red	80	81	82
CHEMICAL CLASS	Azo	Azo	Azo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Red	Bluish Red	Bluish Red
Artificial light (tungsten)	—	—	—
DYEING			
Cellulose	Pad-cure; one-bath pad-steam	Pad-cure; one-bath pad-steam	Pad-cure; one-bath pad-steam
Nylon	—	—	—
Silk	—	—	—
Wool	—	—	—
PRINTING	Neutral steam Paste is stable for more than 28 days at 20°C. Suitable for overprinting with caustic alkali	Neutral steam Paste is stable for 28 days at 20°C. Suitable for overprinting with caustic alkali	Neutral steam Paste is stable for more than 28 days. Suitable for overprinting with caustic alkali
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	—	2 (bluer)	4
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	4	4	3–4
normal	5	4–5	4
2× normal	—	—	—
Peroxide Bleach — Alteration	4	3–4 (mild)	3–4
Staining	5	5	5
Perspiration — Alteration	5 (alkaline)	5 (alkaline)	5 (alkaline)
Staining	5	5	5
Soda Boil — Alteration	4	4–5	4–5
Staining	4–5	5	5
Washing — Alteration	4–5 (once at boil)	5 (once at boil)	5 (once at boil)
Staining	5	5	5
OTHER PROPERTIES			
Dischargeability	Unsuitable for white discharge	Unsuitable for white discharge	Unsuitable for white discharge
Effect of Metals — Copper	—	—	—
Iron	—	—	—
Reactions in Substance			
H_2SO_4 conc.	—	—	—
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE			
NOTES	Solubility in water >100 g/l	Solubility in water >100 g/l	Solubility in water >100 g/l

83	84	85	C.I. Reactive Red
Monoazo	Monoazo	Monoazo	**CHEMICAL CLASS**
—	—	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Bright Red	Bright Yellowish Red	Bright Bluish Red	**HUE** Daylight
—	Slightly yellower	—	Artificial light (tungsten)
—	—	This application is possible, but has no special advantage	**DYEING** Cellulose
—	—	—	Nylon
Suitable	—	—	Silk
Suitable	Suitable	—	Wool
Silk and wool	On silk and wool	Mainly for printing, especially on cellulosic fibres, chlorinated wool and unions; one- and two-step fixation methods	**PRINTING**
Wool ISO	Wool ISO	Cellulose ISO	**FASTNESS PROPERTIES** Fibre Method
2 (bluer)	4–5	2–3	Alkali
—	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
4	5	4	Light — $\frac{1}{3}$—$\frac{1}{2}$ normal
5	6	4–5	normal
5–6	6–7	—	2× normal
4 (bluer)	—	4	Peroxide Bleach — Alteration
5	—	—	Staining
—	—	—	Perspiration — Alteration
—	—	—	Staining
—	—	—	Soda Boil — Alteration
—	—	—	Staining
4 (bluer) (50°C)	4–5 (50°C)	4–5 (ISO4)	Washing — Alteration
5	5	—	Staining
Poor	Good (wool)	Poor	**OTHER PROPERTIES** Dischargeability
4 (bluer)	4 (yellower)	—	Effect of Metals — Copper
4 (bluer)	4 (yellower)	—	Iron
Yellowish red*	Orange brown*	—	Reactions in Substance H_2SO_4 conc.
Bluish red	Reddish orange	Reddish	Dilute HCl
Yellowish red	Reddish orange	—	Dilute NaOH
			NON-TEXTILEUSAGE
Solubility in water: good	Solubility in water: very good. Not sensitive to hard water	Solubility in water: very good	**NOTES**
*On dilution—bluish red	*On dilution—orange brown		

C.I. Reactive Red	86	87	88
CHEMICAL CLASS	Monoazo	Azo	Monoazo
REACTIVE SYSTEM	—	—	Dichlorotriazinyl
C.I. CONSTITUTION NO.	—	—	18205
HUE			
Daylight	Yellowish Red	Bluish Red	Bluish Red
Artificial light (tungsten)	—	Redder	—
DYEING			
Cellulose	Exhaustion dyeing	Exhaustion or pad-batch (cold)	Batchwise exhaustion; cold pad-batch methods Suitable
Nylon	—	—	
Silk	—	—	—
Wool	—	—	—
PRINTING		As ground for discharge printing	Cellulose: 2-phase process
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cellulose
Method	ISO	ISO	ISO
Alkali	3 (soda)	2–3 (bluer)	—
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	3–4	4	—
normal	4–5	5	4–5
2× normal	—	—	—
Peroxide Bleach — Alteration	—	3	—
Staining	—	5	—
Perspiration — Alteration	5 (acid)	4–5	—
Staining	5	5	—
Soda Boil — Alteration	—	3–4 (bluer)	—
Staining	—	3	—
Washing — Alteration	5 (95°C)	5 (95°C)	4–5 (95°C)
Staining	4–5	5	—
OTHER PROPERTIES			
Dischargeability	2 (neutral or alk; exposed or not)	Very good	Very good (neutral)
Effect of Metals — Copper	—	—	—
Iron	—	—	—
Reactions in Substance			
H_2SO_4 conc.	—	—	—
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE			
NOTES	Solubility in water: 100 g/l (30° or 90°C). Good stability in hard water Unsuitable for dead cotton; suitable for barré viscose. Very good stability to resin finishing	Effect threads: acetate, triacetate, acrylic and polyester unstained, nylon slightly stained Fastness on viscose slightly better than on cotton Suitable for crease-resist finishes (usually slightly bluer, with slight loss of light fastness)	Solubility in water: very good; sensitive to hard water Crease-resist finishes: 3–4 (hue bluer)

89	90	91	C.I. Reactive Red
Azo	Monoazo	Monoazo	**CHEMICAL CLASS**
—	—	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Red	Bluish Red	Red	**HUE** Daylight
Yellower	Yellower, brighter	Yellower, brighter	Artificial light (tungsten)
Exhaustion and pad-batch (cold) methods		Pad-(alkali shock), 2-bath pad-steam, pad-dry, pad-(wet fixation), pad-batch processes	**DYEING** Cellulose
—		—	Nylon
—		—	Silk
—		—	Wool
As ground for discharge printing	Pad-steam; pad-(alkali shock)	Cellulose: 2-stage processes, including fixation by air exposure without steaming	**PRINTING**
Cotton ISO	Cotton ISO	Cotton ISO	**FASTNESS PROPERTIES** Fibre Method
2–3	1 (yellower, duller)	1 (bluer, duller)	Alkali
—	3 (bluer) (3 cycles)	3–4 (3 cycles)	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
4	4–5	5	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
4–5	5	6	normal
—	—	—	2× normal
3 (bluer)	—	—	Peroxide Bleach — Alteration
5	—	—	Staining
5	4–5	4–5	Perspiration — Alteration
5	4–5	4–5	Staining
3	—	—	Soda Boil — Alteration
3	—	—	Staining
5 (95°C)	3 (bluer) (95°C)	3–4 (95°C)	Washing — Alteration
5	5	5	Staining
Very good	2 (neutral or alkaline)	2 (neutral or alkaline)	**OTHER PROPERTIES** Dischargeability
—	—	—	Effect of Metals — Copper
—	—	—	Iron
—	—	—	Reactions in Substance
—	—	—	H_2SO_4 conc.
—	—	—	Dilute HCl
—	—	—	Dilute NaOH
			NON-TEXTILE USAGE
Effect threads: acrylic, polyester and triacetate unstained, acetate and nylon stained (nylon brownish)	Solubility in water: 125 g/l Stripping: sodium hypochlorite is more effective than hydrosulphite	Solubility in water: 125 g/l Stripping: sodium hypochlorite is more effective than hydrosulphite	**NOTES**

C.I. Reactive Red	92	93	94
CHEMICAL CLASS	Monoazo	Monoazo	Azo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Red	Red	Yellowish Red
Artificial light (tungsten)	Yellower, brighter	Yellower, brighter	—
DYEING			
Cellulose	Padded and fixed by acid catalyst and dry heat	Padded and fixed by acid catalyst and dry heat	Padded with $NaHCO_3$ and urea; fixed by steaming or dry heat
Nylon	—	—	—
Silk	—	—	—
Wool	—	—	—
PRINTING	Cellulose: printed and fixed by acid catalyst and dry heat	Cellulose: printed and fixed by acid catalyst and dry heat	Cellulose
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cellulose
Method	AATCC	AATCC	AATCC
Alkali	—	—	—
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	—	—
normal	—	—	5
2× normal	—	—	—
Peroxide Bleach — Alteration	—	—	—
Staining	—	—	—
Perspiration — Alteration	3–4	4–5	—
Staining	—	—	—
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	3–4	3	4–5 (Test 3)
Staining	—	—	—
OTHER PROPERTIES			
Dischargeability			
Effect of Metals — Copper			
Iron			
Reactions in Substance			
H_2SO_4 conc.			
Dilute HCl			
Dilute NaOH			
NON-TEXTILE USAGE			
NOTES	Literature: *BP* 1,100,599 McCleary, Cate, Fordemwalt and Loffelman, *Am. Dyestuff Rep.*, 1967, **56**, P46–51	Literature: *BP* 1,100,599 McCleary, Cate, Fordemwalt and Loffelman, *Am. Dyestuff Rep.*, 1967, **56**, P46–51	

95	96	97	C.I. Reactive Red
—	—	Monoazo	CHEMICAL CLASS
—	—	Dichlorophthalazinecarbonyl	REACTIVE SYSTEM
—	—	—	C.I. CONSTITUTION NO.
Red	Bluish Red	Bluish Red	HUE Daylight
4 (yellower)	Little or no change	Little or no change	Artificial light (tungsten)
Pad-thermofix, pad-batch, pad-steam, pad-roll, pad-jig and exhaustion	As for C.I. Reactive Red 95	As for C.I. Reactive Red 95	DYEING Cellulose
—	—	—	Nylon
—	—	—	Silk
—	—	—	Wool
Cellulose: printed with urea and $NaHCO_3$ or Na_2CO_3 and fixed by steaming, thermofix, flash-age (2-phase) or alkali shock processes. Printing paste is stable for more than 4 weeks	Cellulose: as for C.I. Reactive Red 95	Cellulose: as for C.I. Reactive Red 95	PRINTING
Cotton ISO	Cotton ISO	Cotton ISO	FASTNESS PROPERTIES Fibre Method
2 (duller) 5 — — —	3 (bluer) 5 — — —	2 (bluer) 5 — — —	Alkali Burnt Gas Fumes Carbonising — Alkaline rinse Neutral rinse Decatising
5 5–6 —	4–5 5–6 —	4–5 5–6 —	Light — $\frac{1}{3}$—$\frac{1}{2}$ normal normal 2× normal
4–5 5 5 5	3 5 4–5 3–4	4 4–5 4 5	Peroxide Bleach — Alteration Staining Perspiration — Alteration Staining
— —	— —	— —	Soda Boil — Alteration Staining
4 (ISO No.4) 5	4–5 (ISO No.4) 5	4 4–5	Washing — Alteration Staining
3–4 neutral, 4–5 alkaline — —	2–3 neutral, 2 alkaline — —	2–3 neutral, 2 alkaline — —	OTHER PROPERTIES Dischargeability Effect of Metals — Copper Iron
— — —	— — —	— — —	Reactions in Substance H_2SO_4 conc. Dilute HCl Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: 200 g/l at 30°, 60° or 90°C	Solubility in water: 100 g/l at 30°, 60° and 90°C	Solubility in water: 100 g/l at 30°, 60° or 90°C	NOTES

C.I. Reactive Red	98	99	100
CHEMICAL CLASS	Monoazo (metal complex)	Azo	Azo
REACTIVE SYSTEM	Dichlorophthalazinecarbonyl	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Bordeaux	Red	Bluish Red
Artificial light (tungsten)	4 (yellower)	Yellower	Somewhat yellower
DYEING			
Cellulose	As for C.I. Reactive Red 95	Not dyed	Stained
Nylon	—	Dyed	Dyed
Silk	—	Heavily stained	Heavily stained
Wool	—	pH 4.5–5; acetic acid + auxiliary*	pH 4.5–5; acetic acid + Na_2SO_4 + auxiliary*
PRINTING	As for C.I. Reactive Red 95		
FASTNESS PROPERTIES			
Fibre	Cotton	Wool	Wool
Method	ISO	ISO	ISO
Alkali	4 (bluer)	4–5	4
Burnt Gas Fumes	5	—	—
Carbonising — Alkaline rinse	—	4	4
Neutral rinse	—	4–5	4–5
Decatising	—	4–5	4
Light — ⅓–½ normal	6	5–6	5–6
normal	6–7	6–7	6
2× normal	—	6–7	6–7
Peroxide Bleach — Alteration	3	4–5	4–5
Staining	4–5	5	5
Perspiration — Alteration	5	5	5 (acid and alkaline)
Staining	4	5	5
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	4–5 (ISO No.4)	4 (5 × 60°C)	4 (5 × 60°C)
Staining	5	4–5	4–5
OTHER PROPERTIES			
Dischargeability	3 (neutral or alkaline)	4	4
Effect of Metals — Copper	—	4	4–5
Iron	—	4–5	4–5
Reactions in Substance			
H_2SO_4 conc.	—	—	—
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE			
NOTES	Solubility in water: 100 g/l at at 30°, 60° and 90°C	Solubility in water: 91–100 g/l at 90°C *May be aftertreated with ammonia for deep dyeings on wool or chlorinated wool	Solubility in water: 61–70 g/l *May be aftertreated with ammonia for deep dyeings on wool or chlorinated wool

101	102	103	C.I. Reactive Red
Azo	Disazo	Monoazo	CHEMICAL CLASS
—	Monochlorotriazinyl	—	REACTIVE SYSTEM
—	—	—	C.I. CONSTITUTION NO.
Bright Bluish Red	Dull Yellowish Red	Bluish Red	HUE Daylight
—	Redder	Distinctly yellower	Artificial light (tungsten)
4 (a, b), 5 (a, b), 6 (a, b, c)	Exhaustion, pad-thermofix, pad-jig or pad-roll method	Pad-jig, two-bath pad-steam and exhaustion processes	DYEING Cellulose
	—	—	Nylon
Suitable	Weakly alkaline bath	—	Silk
	Weakly acid bath	—	Wool
Cellulose, nylon, silk and wool: as for C.I. Reactive Yellow 2	Cellulosic fibres		PRINTING
Cellulose ISO	Cellulose ISO	Silk ISO	Cotton ISO	FASTNESS PROPERTIES Fibre Method
—	3	—	2 (bluer)	Alkali
—	—	—	—	Burnt Gas Fumes
—	—	—	—	Carbonising — Alkaline rinse
—	—	—	—	Neutral rinse
—	—	—	—	Decatising
—	5–6	5–6	4–5	Light — $\frac{1}{3}$—$\frac{1}{2}$ normal
4–5	6	6	4–5	normal
—	—	—	—	2× normal
—	4	—	—	Peroxide Bleach — Alteration
—	3–4	—	—	Staining
4–5	4	4	5	Perspiration — Alteration
—	3–4	4	5	Staining
—	—	—	—	Soda Boil — Alteration
—	—	—	—	Staining
4 (5 × 95°C)	4	4–5	4 (95°C)	Washing — Alteration
—	4–5	4–5 (silk)	2–3	Staining
Moderate	Good (neutral or alkaline)	White and coloured discharges	OTHER PROPERTIES Dischargeability
—	Slightly redder	—	Effect of Metals — Copper
—	Slightly yellower	—	Iron
—	—	—	Reactions in Substance H_2SO_4 conc.
—	—	—	Dilute HCl
—	—	—	Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: good	Solubility in water: very good	Solubility in water: 100 g/l at the boil PVC coating: suitable Crease-resist finishes: slight change in hue; usually some loss of light fastness	NOTES

C.I. Reactive Red	104	105	106
CHEMICAL CLASS	Monoazo	Monoazo	Monoazo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Bluish Red	Bluish Red	Red
Artificial light (tungsten)	Distinctly yellower, clearer	Somewhat yellower	Distincly yellower
DYEING			
Cellulose	Pad-jig, two-bath pad-steam and exhaustion processes	Pad-jig, two-bath pad-steam and exhaustion processes	Pad-jig, two-bath pad-steam and exhaustion processes
Nylon	—	—	—
Silk	—	—	—
Wool	—	—	—
PRINTING			
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton (mercerised)
Method	ISO	ISO	ISO
Alkali	3 (bluer)	4 (bluer)	1 (bluer, duller)
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	3–4	4	5
normal	4–5	4–5	5–6
2× normal	—	—	—
Peroxide Bleach — Alteration	—	—	—
Staining	—	—	—
Perspiration — Alteration	4 (bluer) (alkaline)	4–5 (acid and alkaline)	4 (bluer) (alkaline)
Staining	5	5	5
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	4 (95°C)	4–5 (95°C)	4–5 (95°C)
Staining	5	5	5
OTHER PROPERTIES			
Dischargeability	White and coloured discharges	White and coloured discharges	White and coloured discharges
Effect of Metals — Copper	—	—	—
Iron	—	—	—
Reactions in Substance			
H_2SO_4 conc.	—	—	—
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE			
NOTES	Solubility in water: 120 g/l at the boil PVC coating: suitable Crease-resist finishes: slight change in hue and usually loss of light fastness	Solubility in water: 80 g/l at the boil PVC coating: suitable Crease-resist finishes: slight change in hue and usually some loss of light fastness	Solubility in water: >200 g/l at the boil PVC coating: suitable Crease-resist finishes: slight change in hue and usually some loss of light fastness

107	108	109	C.I. Reactive Red
Monoazo	Monoazo	Monoazo	CHEMICAL CLASS
Vinylsulphonyl	—	—	REACTIVE SYSTEM
—	—	—	C.I. CONSTITUTION NO.
Bluish Red	Bluish Red	Bluish Red	HUE Daylight
—	—	—	Artificial light (tungsten)
1 (a, b, c), 2 (a, b), 3 (a, b, c)	Padded cold with urea + $NaHCO_3$; fixed by steam or dry heat	Padded cold with urea + $NaHCO_3$; fixed by steam or dry heat	DYEING Cellulose
—	—	—	Nylon
—	—	—	Silk
—	—	—	Wool
Cellulose: printed with $NaHCO_3$, urea and a neutral alginate thickener; fixed by neutral steam or dry heat	Cellulose: direct processes, print paste containing $NaHCO_3$ and a neutral alginate thickener; fixation by neutral steam	Cellulose: direct processes, print paste containing $NaHCO_3$ and a neutral alginate thickener; fixation by neutral steam	PRINTING
Cotton ISO	Cotton ISO	Cotton ISO	FASTNESS PROPERTIES Fibre Method
—	2	1	Alkali
—	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
—	—	—	Light — $\frac{1}{3}$—$\frac{1}{2}$ normal
4	4	4	normal
—	—	—	2× normal
—	—	—	Peroxide Bleach — Alteration
—	—	—	Staining
4–5	5	5	Perspiration — Alteration
5	5	5	Staining
—	—	—	Soda Boil — Alteration
—	—	—	Staining
5 (95°C)	5 (70°C)	5 (70°C)	Washing — Alteration
5	5	5	Staining
	Dischargeable to white	Dischargeable to white	OTHER PROPERTIES Dischargeability
	—	—	Effect of Metals — Copper
	—	—	Iron
	—	—	Reactions in Substance H_2SO_4 conc.
	—	—	Dilute HCl
	—	—	Dilute NaOH
			NON-TEXTILE USAGE
	Solubility in water: good	Solubility in water: good	NOTES

C.I. Reactive Red	110	111
CHEMICAL CLASS	Monoazo	Monoazo
REACTIVE SYSTEM	—	—
C.I. CONSTITUTION NO.	—	—
HUE		
Daylight	Red	Red
Artificial light (tungsten)	—	—
DYEING		
Cellulose	Padded cold with urea+$NaHCO_3$; fixed by steam or dry heat	Padded cold with urea+$NaHCO_3$; fixed by steam or dry heat
Nylon	—	—
Silk	—	—
Wool	—	—
PRINTING	Cellulose: direct processes, print paste containing $NaHCO_3$ and a neutral alginate thickener; fixation by neutral steam	Cellulose: direct processes, print paste containing $NaHCO_3$ and a neutral alginate thickener; fixation by neutral steam
FASTNESS PROPERTIES		
Fibre	Cotton	Cotton
Method	ISO	ISO
Alkali	1	1
Burnt Gas Fumes	—	—
Carbonising — Alkaline rinse	—	—
Neutral rinse	—	—
Decatising	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	—
normal	4–5	4
2× normal	—	—
Peroxide Bleach — Alteration	—	—
Staining	—	—
Perspiration — Alteration	5	5
Staining	5	5
Soda Boil — Alteration	—	—
Staining	—	—
Washing — Alteration	5 (70°C)	5 (70°C)
Staining	5	5
OTHER PROPERTIES		
Dischargeability	Dischargeable to white	Dischargeable to white
Effect of Metals — Copper	—	—
Iron	—	—
Reactions in Substance		
H_2SO_4 conc.	—	—
Dilute HCl	—	—
Dilute NaOH	—	—
NON-TEXTILE USAGE		
NOTES	Solubility in water: good	Solubility in water: good

112	113	C.I. Reactive Red
Monoazo	Monoazo	CHEMICAL CLASS
Vinylsulphonyl	Vinylsulphonyl	REACTIVE SYSTEM
—	—	C.I. CONSTITUTION NO.
Red	Yellowish Red	HUE Daylight
—	—	Artificial light (tungsten)
Padded cold with urea+$NaHCO_3$; fixed by steam or dry heat	Padded cold with urea+$NaHCO_3$; fixed by steam or dry heat	DYEING Cellulose
—	—	Nylon
—	—	Silk
—	—	Wool
Cellulose: direct processes, print paste containing $NaHCO_3$ and a neutral alginate thickener; fixation by neutral steam	Cellulose: direct processes, print paste containing $NaHCO_3$ and a neutral alginate thickener; fixation by neutral steam	PRINTING
Cotton ISO	Cotton ISO	FASTNESS PROPERTIES Fibre Method
1	1	Alkali
—	—	Burnt Gas Fumes
—	—	Carbonising — Alkaline rinse
—	—	Neutral rinse
—	—	Decatising
—	—	Light — $\frac{1}{3}$—$\frac{1}{2}$ normal
4	4–5	normal
—	—	2× normal
—	—	Peroxide Bleach — Alteration
—	—	Staining
5	5	Perspiration — Alteration
5	5	Staining
—	—	Soda Boil — Alteration
—	—	Staining
5 (70°C)	5 (70°C)	Washing — Alteration
5	5	Staining
Dischargeable to white	Dischargeable to white	OTHER PROPERTIES Dischargeability
—	—	Effect of Metals — Copper
—	—	Iron
—	—	Reactions in Substance H_2SO_4 conc.
—	—	Dilute HCl
—	—	Dilute NaOH
		NON-TEXTILE USAGE
Solubility in water: good	Solubility in water: good	NOTES

C.I. Reactive Red	114	115
CHEMICAL CLASS	Monoazo	Xanthene
REACTIVE SYSTEM	Vinylsulphonyl	—
C.I. CONSTITUTION NO.	—	—
HUE		
Daylight	Bluish Red	Fluorescent Yellowish Pink
Artificial light (tungsten)	—	—
DYEING		
Cellulose	Padded cold with urea+$NaHCO_3$; fixed by steam or dry heat	Padded cold with urea+$NaHCO_3$; fixed by steam or dry heat
Nylon	—	—
Silk	—	—
Wool	—	—
PRINTING	Cellulose: direct processes, print paste containing $NaHCO_3$ and a neutral alginate thickener; fixation by neutral steam	Cellulose: direct processes, print paste containing $NaHCO_3$ and a neutral alginate thickener; fixation by neutral steam
FASTNESS PROPERTIES		
Fibre	Cotton	Cotton
Method	ISO	ISO
Alkali	1	3–4
Burnt Gas Fumes	—	—
Carbonising — Alkaline rinse	—	—
Neutral rinse	—	—
Decatising	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	—
normal	4	2
2× normal	—	—
Peroxide Bleach — Alteration	—	—
Staining	—	—
Perspiration — Alteration	5	5
Staining	5	5
Soda Boil — Alteration	—	—
Staining	—	—
Washing — Alteration	5 (70°C)	5 (70°C)
Staining	5	5
OTHER PROPERTIES		
Dischargeability	Dischargeable to white	Dischargeable to white
Effect of Metals — Copper	—	—
Iron	—	—
Reactions in Substance		
H_2SO_4 conc.	—	—
Dilute HCl	—	—
Dilute NaOH	—	—
NON-TEXTILE USAGE		
NOTES	Solubility in water: good	Solubility in water: good

C.I. Reactive Violet 1—3

C.I. Reactive Violet	1	2	3
CHEMICAL CLASS	Azo (copper complex)	Monoazo	Monoazo (copper complex)
REACTIVE SYSTEM	Monochlorotriazinyl	Monochlorotriazinyl	Trichloropyrimidinyl
C.I. CONSTITUTION NO.	—	18157	—
HUE			
Daylight	Bright Violet	Reddish Violet	Reddish Violet
Artificial light (tungsten)	Much redder	—	Much redder
DYEING			
Cellulose	4 (a, b), 5 (a, b), 6 (a, b, c)	4 (a, b), 5 (a, b), 6 (a, b, c)	As for C.I. Reactive Yellow 8
Nylon	Suitable	—	—
Silk	Suitable	—	As for C.I. Reactive Yellow 8
Wool	—	—	As for C.I. Reactive Yellow 8
PRINTING	Cellulose and silk: as for C.I. Reactive Yellow 2 Suitable for printing on C.I. Azoic Components 2 and 5	Cellulose, nylon, silk and wool: as for C.I. Reactive Yellow 2	As for C.I. Reactive Yellow 8
FASTNESS PROPERTIES			
Fibre	Cotton*	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	3–4 (bluer)	3–4 (bluer)	—
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	6	5–6
normal	6–7	6	6–7
2× normal	6–7	—	—
Peroxide Bleach — Alteration	2	—	2–3
Staining	5	—	5
Perspiration — Alteration	—	—	5
Staining	—	—	5
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	5 (5×100°C)	5	5 (95°C)
Staining	5	—	5
OTHER PROPERTIES			
Dischargeability	Unsuitable for discharge	Good	2
Effect of Metals — Copper	4–5 (duller)	4 (weaker)	—
Iron	4–5 (redder)	4–5	—
Reactions in Substance			
H_2SO_4 conc.	—	—	—
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE			
NOTES	Solubility in water: excellent *Fastness on nylon (ISO): light 5; on silk (ISO): light 6	Solubility in water: very good. Not sensitive to hard water Suitable for crease-resist finishes (4, bluer)	Solubility in water: very good Crease-resist finish: trace bluer, light fastness slightly reduced

C.I. Reactive Violet	4	5	6
CHEMICAL CLASS	Monoazo (metal complex)	Monoazo (metal complex)	Azo
REACTIVE SYSTEM	Vinylsulphonyl	Vinylsulphonyl	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Reddish Violet	Violet	Reddish Violet
Artificial light (tungsten)	—	—	Redder, brighter
DYEING			
Cellulose	Padded cold with urea + $NaHCO_3$, dried and fixed by steam or dry heat	As for C.I. Reactive Violet 4	Batchwise exhaustion, 50°→80–85°C
Nylon	—	—	—
Silk	—	—	Salt + Na_3PO_4, 50°→85°C
Wool	—	—	Weak acetic acid, 50°→boil
PRINTING	Cellulose: direct printing with $NaHCO_3$ and a neutral alginate thickener; fixed by neutral steaming. Also by discharge styles	Cellulose: as for C.I. Reactive Violet 4	
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	4	4–5	4
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	6	6	5
normal	6–7	6–7	5–6
2× normal	—	—	—
Peroxide Bleach — Alteration	—	—	4
Staining	—	—	5
Perspiration — Alteration	4	4–5	4 (alkaline, AATCC)
Staining	5	5	5
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	4–5 (75°C)	4–5 (75°C)	5 (95°C)
Staining	5	5	5
OTHER PROPERTIES			
Dischargeability	Dischargeable to white	Dischargeable to white	2–3
Effect of Metals — Copper	—	—	—
Iron	—	—	—
Reactions in Substance			
H_2SO_4 conc.	—	—	—
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE			
NOTES	Solubility in water: good	Solubility in water: good	Solubility in water: very good Suitable for crease-resist finishes; light fastness unchanged

7	8	9	C.I. Reactive Violet
Monoazo	Azo	Azo	**CHEMICAL CLASS**
—	—	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Reddish Violet	Bright Reddish Violet	Bright Bluish Violet	**HUE** Daylight
—	—	—	Artificial light (tungsten)
Exhaustion or padding; fixed by cold batch, dry heat or steaming	Main use	Main use	**DYEING** Cellulose
—	Suitable	Suitable	Nylon
—			Silk
—			Wool
			PRINTING
Cotton ISO	Cotton* ISO	Cotton* ISO	**FASTNESS PROPERTIES** Fibre Method
4–5 (bluer)	4–5	4–5	Alkali
—	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
6	—	—	Light — $\frac{1}{3}$—$\frac{1}{2}$ normal
6	4	3–4	normal
—	—	—	2× normal
2	—	—	Peroxide Bleach — Alteration
4–5	—	—	Staining
5	5	5	Perspiration — Alteration
5	4–5	4–5	Staining
1–2	—	—	Soda Boil — Alteration
4–5	—	—	Staining
5 (60°C)	4–5 (95°C)	4–5 (95°C)	Washing — Alteration
5	4–5	5	Staining
	Good (wool)	Poor (wool)	**OTHER PROPERTIES** Dischargeability
	—	—	Effect of Metals — Copper
			Iron
	—	—	Reactions in Substance
	—	—	H_2SO_4 conc.
	—	—	Dilute HCl
	—	—	Dilute NaOH
			NON-TEXTILE USAGE
Sensitive to hard water Effect threads: acetate and nylon slightly stained, polyester and triacetate unstained Suitable for crease-resist finishes (bluer; poorer light fastness)	Solubility in water: 20 g/l Suitable for crease-resist finishes (reduced light fastness) *Light fastness on nylon and silk 3; on wool 4. Washing fastness (60°C) on silk 5 (5)	Solubility in water: 100 g/l Suitable for crease-resist finishes (reduced light fastness) *Light fastness on nylon and silk 2; on wool 3. Washing fastness (60°C) on silk 5 (5)	**NOTES**

C.I. Reactive Violet	10	11	12
CHEMICAL CLASS	Azo	Azo (metallised)	Azo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Bright Violet	Dull Reddish Violet	Reddish Violet
Artificial light (tungsten)	—	—	Redder
DYEING			
Cellulose	Main use	Alkaline pad liquor containing urea; one-bath pad-steam or heat fixation*	Exhaustion or pad-fix
Nylon	Suitable	—	—
Silk	Suitable	—	—
Wool	Suitable	—	—
PRINTING		Alkaline paste containing urea and special assistant, thickened with alginate; dried and fixed with neutral steam	
FASTNESS PROPERTIES			
Fibre	Cotton*	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	3–4 (redder)	—	4 (redder)
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	5	5
normal	5–6	5–6	6
2× normal	—	—	6–7
Peroxide Bleach — Alteration	—	4–5	2
Staining	—	5	5
Perspiration — Alteration	5	4–5	—
Staining	4–5	5	—
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	5 (95°C)	4–5	4–5
Staining	4–5	5	5
OTHER PROPERTIES			
Dischargeability	Poor (wool)	--	Not dischargeable
Effect of Metals — Copper	—	—	5
Iron	—	—	4
Reactions in Substance			
H_2SO_4 conc.	—	Violet brown; on diln—brownish red	Reddish violet
Dilute HCl	—	—	Yellowish red
Dilute NaOH	—	Weaker	Reddish violet
NON-TEXTILE USAGE			
NOTES	Solubility in water: 70 g/l Suitable for crease-resist finishes (reduced light fastness) *Light fastness on nylon 3–4; on silk 4–5; on wool 4. Washing fastness (60°C) on silk 4–5 (5)	Solubility in water: 100 g/l Suitable for crease-resist finishes *This dye does not react directly with the fibre, but requires the use of a fixing agent	Solubility in water: very good

13	14	15	C.I. Reactive Violet
Azo	Azo	Azo (1:1 copper complex)	**CHEMICAL CLASS**
—	—	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Bright Reddish Violet	Bluish Violet	Reddish Violet	**HUE**
—	—	—	Daylight
			Artificial light (tungsten)
1 (a, b, c), 2 (a, b), 3 (a, b, c)	1 (a, b, c), 2 (a, b), 3 (a, b, c)		**DYEING**
			Cellulose
As for C.I. Reactive Yellow 1	As for C.I. Reactive Yellow 1		Nylon
			Silk
			Wool
Direct printing on cellulose, nylon, silk and wool	Direct printing on cellulose, nylon, silk and wool	Machine printing; one-bath pad-steam and thermofixation processes	**PRINTING**
Cotton	Cotton	Cotton	**FASTNESS PROPERTIES**
ISO	ISO	ISO	Fibre
			Method
—	—	—	Alkali
—	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
—	—	5	Light — $\frac{1}{3}$—$\frac{1}{2}$ normal
4–5	3–4	6	normal
—	—	—	2× normal
—	—	3–4 (Wash)	Peroxide Bleach — Alteration
—	—	5	Staining
4	4	4	Perspiration — Alteration
—	—	4	Staining
—	—	—	Soda Boil — Alteration
—	—	—	Staining
3 (5×95°C)	3 (5×95°C)	4 (ISO 4)	Washing — Alteration
—	—	4–5	Staining
Moderate	Moderate		**OTHER PROPERTIES**
—	—		Dischargeability
—	—		Effect of Metals — Copper
—	—		Iron
—	—		Reactions in Substance
—	—		H_2SO_4 conc.
—	—		Dilute HCl
—	—		Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: good	Solubility in water: good	This dye does not react directly with the fibre but requires the use of a fixing agent	**NOTES**

C.I. Reactive Violet	16	17	18
CHEMICAL CLASS	Azo	Azo	Azo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Reddish Violet	Violet	Bluish Violet
Artificial light (tungsten)	—	—	—
DYEING			
Cellulose	Pad-cure and one-bath pad-steam methods	Pad-cure and one-bath pad-steam methods	Pad-cure and one-bath pad-steam methods
Nylon	—	—	—
Silk	—	—	—
Wool	—	—	—
PRINTING	Neutral steam Print paste is stable for >28 days at 20°C Suitable for overprinting with caustic alkali	Neutral steam Print paste is stable for more than 28 days at 20°C Suitable for overprinting with caustic alkali	Neutral steam Print paste is stable for more than 28 days at 20°C Suitable for overprinting with caustic alkali
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	4	3–4 (bluer)	3–4 (redder)
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — ⅓–½ normal	4	4–5	5–6
normal	4–5	5	6
2× normal	—	—	—
Peroxide Bleach — Alteration	4	1	1
Staining	5	5	5
Perspiration — Alteration	5	3–4 (bluer)	3 (bluer) (alkaline)
Staining	5	5	5
Soda Boil — Alteration	4–5	4–5	4
Staining	5	5	5
Washing — Alteration	4–5 (once at boil)	5 (once at boil)	4–5 (once at boil)
Staining	5	5	5
OTHER PROPERTIES			
Dischargeability	Unsuitable for white discharges	Unsuitable for white discharges	Unsuitable for white discharges
Effect of Metals — Copper	—	—	—
Iron	—	—	—
Reactions in Substance			
H_2SO_4 conc.	—	—	—
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE			
NOTES	Solubility in water >100 g/l	Solubility in water >100 g/l	Solubility in water: 60 g/l

19	20	21	C.I. Reactive Violet
Monoazo	Azo	Azo	**CHEMICAL CLASS**
Dichlorophthalazinecarbonyl	—	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Reddish Violet	Bluish Violet	Reddish Violet	**HUE** Daylight
Yellower	—	—	Artificial light (tungsten)
Pad-thermofix, pad-batch, pad-steam, pad-roll, pad-jig & exhaustion methods	4 (a, b), 5 (a, b), 6 (a, b, c)	4 (a, b), 5 (a, b), 6 (a, b, c)	**DYEING** Cellulose
—	Suitable	Suitable	Nylon
—			Silk
—			Wool
Cellulose: printed with urea and $NaHCO_3$ or Na_2CO_3; fixed by steaming, thermofix, flash age or alkali shock (cold or hot) method. Alkaline paste is stable for more than 4 weeks	Cellulose, nylon, silk and wool: as for C.I. Reactive Yellow 2	Cellulose: nylon, silk and wool: as for C.I. Reactive Yellow 2	**PRINTING**
Cotton ISO	Cellulose ISO	Cellulose ISO	**FASTNESS PROPERTIES** Fibre Method
3 (deeper, duller)	—	—	Alkali
5	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
4	—	—	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
4–5	6	6	normal
—	—	—	2× normal
4	—	—	Peroxide Bleach — Alteration
4	—	—	Staining
5	4–5	4–5	Perspiration — Alteration
4	—	—	Staining
—	—	—	Soda Boil — Alteration
—	—	—	Staining
4 (ISO4)	3–4 (5×95°C)	3–4 (5×95°C)	Washing — Alteration
5	—	—	Staining
2 (neutral), 3 (alkaline)	Poor	Poor	**OTHER PROPERTIES** Dischargeability
—	—	—	Effect of Metals — Copper
—	—	—	Iron
—	—	—	Reactions in Substance
—	—	—	H_2SO_4 conc.
—	—	—	Dilute HCl
—	—	—	Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: 100, 125, 150 g/l at 30°, 60° and 90°C respectively	Solubility in water: good	Solubility in water: good	**NOTES**

C.I. Reactive Violet	22	
CHEMICAL CLASS	Anthraquinone	
REACTIVE SYSTEM	—	
C.I. CONSTITUTION NO.	—	
HUE		
Daylight	Violet	
Artificial light (tungsten)	—	
DYEING		
Cellulose	Padded cold with urea+$NaHCO_3$; fixed by steam or dry heat	
Nylon	—	
Silk	—	
Wool	—	
PRINTING	Cellulose: direct processes, print paste containing $NaHCO_3$ and a neutral alginate thickener; fixation by neutral steam	
FASTNESS PROPERTIES		
Fibre	Cotton	
Method	ISO	
Alkali	4	
Burnt Gas Fumes	—	
Carbonising — Alkaline rinse	—	
Neutral rinse	—	
Decatising	—	
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	
normal	6–7	
2× normal	—	
Peroxide Bleach — Alteration	—	
Staining	—	
Perspiration — Alteration	3–4	
Staining	5	
Soda Boil — Alteration	—	
Staining	—	
Washing — Alteration	5 (70°C)	
Staining	5	
OTHER PROPERTIES		
Dischargeability	Dischargeable to white	
Effect of Metals — Copper	—	
Iron	—	
Reactions in Substance		
H_2SO_4 conc.	—	
Dilute HCl	—	
Dilute NaOH	—	
NON-TEXTILE USAGE		
NOTES	Solubility in water: good	

C.I. Reactive Blue	1	2	3
CHEMICAL CLASS	Anthraquinone	Anthraquinone	Phthalocyanine
REACTIVE SYSTEM	Dichlorotriazinyl	Monochlorotriazinyl	—
C.I. CONSTITUTION NO.	—	61211	—
HUE			
Daylight	Bright Greenish Blue	Bright Blue	Bright Greenish Blue
Artificial light (tungsten)	Little greener	Little greener	Much greener
DYEING			
Cellulose	1 (a, b, c), 2 (a, b), 3 (a, b, c)	4 (a, b), 5 (a, b), 6 (a, b, c)	As for C.I. Reactive Yellow 2
Nylon	As for C.I. Reactive Yellow 1	As for C.I. Reactive Yellow 1	As for C.I. Reactive Yellow 1
Silk		As for C.I. Reactive Yellow 3	As for C.I. Reactive Yellow 3
Wool		As for C.I. Reactive Yellow 1	As for C.I. Reactive Yellow 1
PRINTING	Cellulose, silk and wool: as for C.I. Reactive Yellow 1	Cellulose, nylon, silk and wool: as for C.I. Reactive Yellow 2 Resist styles on cellulose. Suitable for printing on C.I. Azoic Coupling Component 5	Cellulose, nylon, silk and wool: as for C.I. Reactive Yellow 2

FASTNESS PROPERTIES

Fibre / Method	1 Cotton ISO	1 Nylon ISO	1 Silk ISO	2 Cotton ISO	2 Nylon ISO	2 Silk ISO	3 Cotton ISO	3 Nylon ISO	3 Silk ISO
Alkali	3 (greener)	—	—	3–4 (greener)	—	—	5	—	—
Burnt Gas Fumes	—	—	—	—	—	—	—	—	—
Carbonising — Alkaline rinse	—	—	—	—	—	—	—	—	—
Neutral rinse	—	—	—	—	—	—	—	—	—
Decatising	—	—	—	—	—	—	—	—	—
Light — ⅛—½ normal	—	5	5–6	6–7	6–7	6–7	—	3–4	4–5
normal	6–7	6	5–6	6–7	6–7	6–7	4–5	3–4	4–5
2× normal	6–7	—	5–6	6–7	—	—	5	—	—
Peroxide Bleach — Alteration	3	5	4–5	4–5	5	5	1	5	4–5
Staining	4–5	5	5	5	5	5	3	5	4–5
Perspiration — Alteration	4–5 (duller)	—	—	4–5	—	—	4	—	—
Staining	4–5	—	—	5	—	—	4	—	—
Soda Boil — Alteration	—	—	—	—	—	—	—	—	—
Staining	—	—	—	—	—	—	—	—	—
Washing — Alteration	3–4*	5*	5†	4*	3*	4–5 (brighter)†	3*	5*	5†
Staining	5	5	5	5	5	5	3	5	4–5

OTHER PROPERTIES	1	2	3
Dischargeability	Coloured discharges (low depths)	Moderate white (low depths)	Moderate white (low depths)
Effect of Metals — Copper	4–5 (greener)	4 (duller)	3 (greener, duller)
Iron	Unchanged	4 (greener)	3 (greener, duller)
Reactions in Substance			
H_2SO_4 conc.	—	Violet; on dilution—blue	—
Dilute HCl	—	Redder	—
Dilute NaOH	—	Unchanged	—
NON-TEXTILE USAGE			
NOTES	Solubility in water: very good *5 × 100°C †95°C	Solubility in water: very good. Not sensitive to hard water Suitable for crease-resist finishes (4–5) *5 × 100°C †95°C	Solubility in water: very good *5 × 100°C †95°C

C.I. Reactive Blue	4			5
CHEMICAL CLASS	Anthraquinone			Anthraquinone
REACTIVE SYSTEM	Dichlorotriazinyl			Monochlorotriazinyl
C.I. CONSTITUTION NO.	**61205**			**61210**
HUE				
Daylight	Bright Blue			Bright Blue
Artificial light (tungsten)	Duller			Duller
DYEING				
Cellulose	1 (a, b, c), 2 (a, b), 3 (a, b, c)			4 (a, b), 5 (a, b), 6 (a, b, c)
Nylon	As for C.I. Reactive Yellow 1			—
Silk				—
Wool				As for C.I. Reactive Yellow 1
PRINTING	Cellulose, nylon, silk and wool: as for C.I. Reactive Yellow 1			Cellulose, nylon, silk and wool; as for C.I. Reactive Yellow 2 Resist styles on cellulose. Suitable for printing on C.I. Azoic Coupling Components 2 and 5
FASTNESS PROPERTIES				
Fibre	Cotton	Nylon	Silk	Cotton
Method	ISO	ISO	ISO	ISO
Alkali	4–5 (greener)	—	—	4–5
Burnt Gas Fumes	—	—	—	—
Carbonising — Alkaline rinse	—	—	—	—
Neutral rinse	—	—	—	—
Decatising	—	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	6	5–6	5–6 (redder)
normal	6	—	—	5–6 (redder)
2× normal	6–7	—	—	—
Peroxide Bleach — Alteration	3–4	4–5	3	5
Staining	4–5	5	5	5
Perspiration — Alteration	4 (weaker, greener)	—	—	5
Staining	5	—	—	5
Soda Boil — Alteration	—	—	—	—
Staining	—	—	—	—
Washing — Alteration	4*	4 (greener)*	4–5	4–5
Staining	4–5	4–5	5	5
OTHER PROPERTIES				
Dischargeability	Unsuitable for discharge			Moderate white from low depths
Effect of Metals — Copper	Unaffected			4 (greener)
Iron	Unaffected			4–5
Reactions in Substance				
H_2SO_4 conc.	—			Violet; on dilution—blue
Dilute HCl	—			Redder
Dilute NaOH	—			Unchanged
NON-TEXTILE USAGE				
NOTES	Solubility in water: excellent *5 × 100°C †95°C			Solubility in water: very good. Not sensitive to hard water Suitable for crease-resist finishes (4)

6	7	C.I. Reactive Blue
Anthraquinone	Phthalocyanine	**CHEMICAL CLASS**
—	Monochlorotriazinyl	**REACTIVE SYSTEM**
—	**74460**	**C.I. CONSTITUTION NO.**
Bright Blue	Greenish Blue	**HUE** Daylight
Duller	—	Artificial light (tungsten)
—	4 (a, b), 5 (a, b), 6 (a, b, c)	**DYEING** Cellulose
Weak acetic acid at 85–100°C; Na_2CO_3 added for fixation	—	Nylon
—	—	Silk
—	—	Wool
Nylon: acetic acid, sodium acetate, sodium chlorate + thickening; steamed Acetate and triacetate: urea, sodium chlorate + thickening; steamed	Nylon, silk and wool: direct methods; fixed by steaming	**PRINTING**
Nylon ISO / Acetate ISO / Triacetate ISO	Cotton ISO	**FASTNESS PROPERTIES** Fibre Method
5 / — / —	3 (greener)	Alkali
— / 3–4 (redder, duller) / 2 (redder)	—	Burnt Gas Fumes
3–4 / — / —	—	Carbonising — Alkaline rinse
— / — / —	—	Neutral rinse
5 / — / —	—	Decatising
— / — / —	6	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
5 / 5–6 (redder) / 4–5 (redder)	6	normal
5 / 5–6 (redder) / 5–6 (redder)	—	2× normal
— / — / —	2	Peroxide Bleach — Alteration
— / — / —	—	Staining
5 / 5 / 5	—	Perspiration — Alteration
— / 3 / 3–4	—	Staining
— / — / —	—	Soda Boil — Alteration
— / — / —	—	Staining
5 / 4–5 (ISO 3) / 5 (ISO 3)	4–5	Washing — Alteration
— / 4–5 / 5	—	Staining
Unsuitable for discharge	Very good	**OTHER PROPERTIES** Dischargeability
5	3	Effect of Metals — Copper
5	2–3 (greener)	Iron
—	Green; on dilution—turquoise	Reactions in Substance H_2SO_4 conc.
—	Greener	Dilute HCl
—	Greener	Dilute NaOH
		NON-TEXTILE USAGE
	Solubility in water: very good. Not sensitive to hard water Crease resist finish: suitable (4–5), but requires neutralisation after finishing to avoid phototropic effects	**NOTES**

C.I. Reactive Blue	8	9	10
CHEMICAL CLASS	Azo	Azo (copper complex)	Azo
REACTIVE SYSTEM	Trichloropyrimidinyl	Dichlorotriazinyl	Trichloropyrimidinyl
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Navy	Reddish Navy	Reddish Navy
Artificial light (tungsten)	Duller	Redder, duller	Much redder
DYEING			
Cellulose	Continuous, pad(alkali)-batch and batchwise processes*	1 (a, b, c), 2 (a, b), 3 (a, b, c)	As for C.I. Reactive Blue 8
Nylon	—	As for C.I. Reactive Yellow 1	—
Silk	Salt + Na_3PO_4 at 50°→85°C		As for C.I. Reactive Blue 8
Wool	—	—	—
PRINTING	Cellulose, silk and wool: as for C.I. Reactive Yellow 8		Cellulose, silk and wool: as for C.I. Reactive Yellow 8
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton*	Cotton
Method	ISO	ISO	ISO
Alkali	4	3–4 (greener)	5
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — ⅛–½ normal	4–5	—	4–5
normal	5	5	5
2× normal	6 (as navy)	5–6	6–7 (as navy)
Peroxide Bleach — Alteration	2 (washing)	1	4–5 (wash)
Staining	5	3–4	5
Perspiration — Alteration	4–5	5	5
Staining	5	3	5
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	5 (95°C)	4 (5 × 100°C)	4–5 (95°C)
Staining	5	3–4	5
OTHER PROPERTIES			
Dischargeability	2	Moderate white from low depths	2
Effect of Metals — Copper	—	Unaffected	—
Iron	—	4–5 (redder)	—
Reactions in Substance			
H_2SO_4 conc.	—	—	—
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE			
NOTES	Solubility in water: very good Not sensitive to hard water Crease-resist finish: lighter; light fastness unchanged *Or Na_2SO_4, 50°→95°C	Solubility in water: very good *Fastness to light (ISO): on nylon 5, on silk 4	Solubility in water: very good Crease-resist finish: greener; light fastness slightly reduced

11	12	13	C.I. Reactive Blue
Phthalocyanine	Anthraquinone	Monoazo (copper complex)	CHEMICAL CLASS
—	—	Monochlorotriazinyl	REACTIVE SYSTEM
—	—	—	C.I. CONSTITUTION NO.
Blue	Reddish Blue	Blue	HUE Daylight
—	—	Duller	Artificial light (tungsten)
—	—	4 (a, b), 5 (a, b), 6 (a, b, c)	DYEING Cellulose
—	—	—	Nylon
—	—	—	Silk
—	—	Acid (for ingrain effects). Acetic acid + cationic agent for level dyeing	Wool
Cellulose: printed with alkali and alginate or emulsion thickening; fixed by neutral steaming or baking	Cellulose: printed with alkali and alginate or emulsion thickening; fixed by neutral steaming or baking	Cellulose, silk and wool: as for C.I. Reactive Yellow 2	PRINTING
Cotton ISO	Cotton ISO	Cotton ISO	FASTNESS PROPERTIES Fibre Method
—	—	4–5 (greener)	Alkali
—	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
6	4	6	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
6–7	4–5	6–7	normal
—	5–6	—	2× normal
3	4–5	3–4	Peroxide Bleach — Alteration
3	4–5	—	Staining
—	—	—	Perspiration — Alteration
—	—	—	Staining
—	—	—	Soda Boil — Alteration
—	—	—	Staining
4–5	5	4 (5 × 100°C)	Washing — Alteration
5	5	4–5	Staining
Good (alkaline)	Not dischargeable	Poor	OTHER PROPERTIES Dischargeability
—	—	4–5	Effect of Metals — Copper
—	—	4 (duller)	Iron
Green; on dilution—blue	Blue; on dilution—blue	Greener; on dilution—violet	Reactions in Substance H_2SO_4 conc.
—	Trace weaker	Redder	Dilute HCl
—	Weaker	No change	Dilute NaOH
			NON-TEXTILE USAGE
Especially suitable for crease-resist finishes	Suitable for crease-resist finishes	Solubility in water: very good. Not sensitive to hard water Suitable for crease-resist finishes (4, greener)	NOTES

C.I. Reactive Blue	14	15	16
CHEMICAL CLASS	Phthalocyanine	Phthalocyanine	Anthraquinone
REACTIVE SYSTEM	Monochlorotriazinyl	Monochlorotriazinyl	Trichloropyrimidinyl
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Bright Greenish Blue	Greenish Blue	Bright Blue
Artificial light (tungsten)	—	—	Yellower, brighter
DYEING			
Cellulose	4 (a, b), 5 (a, b), 6 (a, b, c)	4 (a, b), 5 (a, b), 6 (a, b, c)	As for C.I. Reactive Yellow 8
Nylon	—	—	—
Silk	—	—	As for C.I. Reactive Yellow 8
Wool	—	—	As for C.I. Reactive Yellow 8
PRINTING	Cotton: as for C.I. Reactive Yellow 2	Cellulose, silk and wool: as for C.I. Reactive Yellow 2	Cellulose, silk and wool: as for C.I. Reactive Yellow 8
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	4 (greener)	4–5	—
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	7	6	5
normal	7–8	6–7	6
2× normal	—	—	—
Peroxide Bleach — Alteration	2 (greener, weaker)	2 (greener, weaker)	4 (wash)
Staining	—	—	5
Perspiration — Alteration	—	—	4–5
Staining	—	—	5
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	4–5	4–5	4–5 (95°C)
Staining	—	—	5
OTHER PROPERTIES			
Dischargeability	Good	Very good	
Effect of Metals — Copper	4–5	4 (greener)	
Iron	3–4 (greener)	3–4 (greener)	
Reactions in Substance			
H_2SO_4 conc.	Greener; on diln—turquoise	Greener; on diln—turquoise	
Dilute HCl	Unchanged	Greener	
Dilute NaOH	Greener	Unchanged	
NON-TEXTILE USAGE			
NOTES	Solubility in water: very good. Not sensitive to hard water. Not recommended for application to regenerated cellulosic fibres. Suitable for crease-resist finishes (4–5)	Solubility in water: very good. Not sensitive to hard water. Suitable for crease-resist finishes (3–4, greener, weaker), but there may be phototropic effects	Solubility in water: very good. Crease-resist finishes: trace weaker; light fastness unaffected

17	18	19*	C.I. Reactive Blue
Anthraquinone	Phthalocyanine	Anthraquinone	**CHEMICAL CLASS**
Trichloropyrimidinyl	Trichloropyrimidinyl	Vinylsulphonyl	**REACTIVE SYSTEM**
—	—	61200	**C.I. CONSTITUTION NO.**
Bright Blue	Greenish Blue	Bright Blue	**HUE** Daylight
Much duller, redder	Much greener	—	Artificial light (tungsten)
As for C.I. Reactive Yellow 8	As for C.I. Reactive Yellow 8 or Na_2SO_4, 50°→95°C	Padded with urea and $NaHCO_3$, dried and fixed by steam or dry heat	**DYEING** Cellulose
—	—	—	Nylon
As for C.I. Reactive Yellow 8	As for C.I. Reactive Yellow 8	—	Silk
		—	Wool
Cellulose, silk and wool: as for C.I. Reactive Yellow 8	Cellulose, silk and wool: as for C.I. Reactive Yellow 8	Cellulose: direct printing with $NaHCO_3$ and a neutral alginate thickener; fixed by neutral steaming Also by discharge styles	**PRINTING**
Cotton ISO	Cotton ISO	Cotton ISO	**FASTNESS PROPERTIES** Fibre Method
3–4	3–4	5	Alkali
—	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
5–6	4–5	6–7	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
6	5–6	7	normal
—	—	—	2× normal
4–5 (wash)	3 (wash)	—	Peroxide Bleach — Alteration
5	3	—	Staining
5	5	4–5	Perspiration — Alteration
5	5	5	Staining
—	—	—	Soda Boil — Alteration
—	—	—	Staining
5 (95°C)	3–4 (95°C)	4–5 (75°C)	Washing — Alteration
5	4	5	Staining
2	3 (neutral), 2 (alk), 3–4 (special)	Dischargeable to white	**OTHER PROPERTIES** Dischargeability
—	—	—	Effect of Metals — Copper
—	—	—	Iron
			Reactions in Substance
—	—	—	H_2SO_4 conc.
—	—	—	Dilute HCl
—	—	—	Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: very good Crease-resist finishes: some change, depending on the resin used; light fastness unaffected	Solubility in water: 60 g/l. Not sensitive to hard water Crease-resist finishes: hue unaffected, but there may be phototropic effects; light fastness slightly reduced	Solubility in water: good *Information relating to dyes listed under C.I. Reactive Blue 19:1 is shown under C.I. Reactive Blue 37 (p.3506), where they were formerly listed	**NOTES**

C.I. Reactive Blue	20	21
CHEMICAL CLASS	Monoazo (metal complex)	Phthalocyanine
REACTIVE SYSTEM	Vinylsulphonyl	Vinylsulphonyl
C.I. CONSTITUTION NO.	—	—
HUE		
Daylight	Navy	Bright Bluish Green
Artificial light (tungsten)	—	—
DYEING		
Cellulose	Padded with urea and $NaHCO_3$, dried and fixed by steam or dry heat	Padded with urea and $NaHCO_3$, dried and fixed by steam or dry heat
Nylon	—	—
Silk	—	—
Wool	—	—
PRINTING	Cellulose: direct printing with $NaHCO_3$ and a neutral alginate thickener; fixed by neutral steaming Also by discharge styles	Cellulose: direct printing with $NaHCO_3$ and a neutral alginate thickener; fixed by neutral steaming Also by discharge styles
FASTNESS PROPERTIES		
Fibre	Cotton	Cotton
Method	ISO	ISO
Alkali	4–5	3
Burnt Gas Fumes	—	—
Carbonising — Alkaline rinse	—	—
Neutral rinse	—	—
Decatising	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	5–6	5–6
normal	6	6
2× normal	—	—
Peroxide Bleach — Alteration	—	—
Staining	—	—
Perspiration — Alteration	4–5	5
Staining	4	4–5
Soda Boil — Alteration	—	—
Staining	—	—
Washing — Alteration	4–5 (75°C)	4 (75°C)
Staining	5	4
OTHER PROPERTIES		
Dischargeability	Dischargeable to white	Dischargeable to white
Effect of Metals — Copper	—	—
Iron	—	—
Reactions in Substance		
H_2SO_4 conc.	—	—
Dilute HCl	—	—
Dilute NaOH	—	—
NON-TEXTILE USAGE		
NOTES	Solubility in water: good	Solubility in water: good

22	23	24	C.I. Reactive Blue
—	Phthalocyanine	Anthraquinone	**CHEMICAL CLASS**
—	—	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Dull Navy	Greenish Blue	Bright Reddish Blue	**HUE** Daylight
Redder and duller	—	—	Artificial light (tungsten)
As for C.I. Reactive Yellow 8. Also batchwise exhaustion from salt bath	Pad-steam or pad-bake	Pad-steam or pad-bake	**DYEING** Cellulose
—	—	—	Nylon
Salt + Na_3PO_4 at 50°→85°C	—	—	Silk
—	—	—	Wool
Cellulose, silk and wool: as for C.I. Reactive Yellow 8	Cellulose; alkaline paste with alginate or emulsion thickening; fixed by neutral steaming or baking	Cellulose: alkaline paste with alginate or emulsion thickening; fixed by neutral steaming or baking	**PRINTING**
Cotton ISO	Cotton ISO	Cotton ISO	**FASTNESS PROPERTIES** Fibre Method
— — — — —	— — — — —	— — — — —	Alkali Burnt Gas Fumes Carbonising — Alkaline rinse Neutral rinse Decatising
5–6 6 6–7	6 6–7 —	3–4 4 4–5	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal
4–5 5 5 4–5	4–5 4–5 — —	5 5 — —	Peroxide Bleach — Alteration Staining Perspiration — Alteration Staining
— — 5 (95°C) 5	— — 4–5 (Test 4) 4–5	— — 5 (Test 4) 5	Soda Boil — Alteration Staining Washing — Alteration Staining
2 — — — — —	Good (alkaline) — — Green — —	Poor (alkaline) — — Blue — —	**OTHER PROPERTIES** Dischargeability Effect of Metals — Copper Iron Reactions in Substance H_2SO_4 conc. Dilute HCl Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: good Suitable for crease-resist finishes (greener; light fastness reduced)	Suitable for crease-resist finishes	Suitable for crease-resist finishes	**NOTES**

C.I. Reactive Blue	25	26	27
CHEMICAL CLASS	Phthalocyanine	Disazo (copper complex)	Anthraquinone
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Greenish Blue	Navy	Bright Blue
Artificial light (tungsten)	Greener	Redder	Very slightly duller
DYEING			
Cellulose	Pad-fix or batchwise processes; dyeing temperature 90–95°C*	4 (a, b), 5 (a, b), 6 (a, b, c) High substantivity*	Pad-batch or exhaustion process
Nylon	—	—	—
Silk	—	—	—
Wool	—	—	—
PRINTING	Cellulose: steaming, dry heat, high-temperature steaming, flash-age (2-phase) and wet development processes Printing on C.I. Azoic Coupling Components 2 and 5†	Cellulose: as for C.I. Reactive Yellow 2 (not suitable for pad-bake on viscose)	
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	4–5 (Na_2CO_3)	3–4	4–5
Burnt Gas Fumes	4–5	2	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	—	—
normal	5–6	5	7
2× normal	6	5–6	—
Peroxide Bleach — Alteration	3–4	1–2	—
Staining	3	3–4	—
Perspiration — Alteration	4–5	4	4–5 (alkaline)
Staining	3	3	4–5
Soda Boil — Alteration	4	3	—
Staining	2	3	—
Washing — Alteration	4 (ISO 5)	4 (ISO 5)	3–4 (95°C)
Staining	3–4	4	5
OTHER PROPERTIES			
Dischargeability	Moderate–poor	Moderate	Dischargeable to white
Effect of Metals — Copper	3–4	4–5	—
Iron	4	4–5	—
Reactions in Substance			
H_2SO_4 conc.	—	—	—
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE			
NOTES	Solubility in water: 140 g/l at 50°C, 120 g/l with 30 g/l salt. Moderate substantivity; low reactivity Effect threads: nylon, polyester, triacetate 3–4; acrylic, acetate, wool 1 Crease-resist finishes: suitable (some hue change; may become phototropic) *Non-ionic wetting agents should not be used †Suitable for printing on nylon, silk, chlorinated wool and polyester-cotton unions	Solubility in water: 200 g/l at 50°C., 180 g/l with 30 g/l salt Suitable for crease-resist finishes (some change of hue and loss of light fastness) *Metal sequestering agents must not be added to the dyebath	Solubility in water: 90 g/l at boil Suitable for crease-resist finishes (hue slightly greener; light fastness may be reduced) Suitable for PVC coating

28	29	30	C.I. Reactive Blue
Monoazo	Anthraquinone	Phthalocyanine	**CHEMICAL CLASS**
—	—	Chloroquinoxaline	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Bluish Violet	Blue	Greenish Blue	**HUE** Daylight
—	—	Greener	Artificial light (tungsten)
Pad-batch method	Exhaustion or padding	Neutral salt bath, followed by alkali, or pad-batch	**DYEING** Cellulose
—	—	—	Nylon
—	—	—	Silk
—	—	—	Wool
			PRINTING
Cotton ISO	Cotton ISO	Cotton AATCC	**FASTNESS PROPERTIES** Fibre Method
—	5	—	Alkali
—	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
—	5–6	2	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
6–7	5	2–3	normal
—	—	3–4	2× normal
—	3–4	—	Peroxide Bleach — Alteration
—	5	—	Staining
3–4 (redder) (alkaline)	5	4–5	Perspiration — Alteration
4–5	5	4–5	Staining
—	3–4 (redder)	—	Soda Boil — Alteration
—	3–4	—	Staining
3–4 (95°C)	5 (60°C)	3–4 (greener) (Test 3A)	Washing — Alteration
5	5	3–4	Staining
		—	**OTHER PROPERTIES** Dischargeability
		—	Effect of Metals — Copper
		—	Iron
		Yellowish green	Reactions in Substance H_2SO_4 conc.
		—	Dilute HCl
		—	Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: 80 g/l Suitable for crease-resist finishes	Effect threads: acetate and nylon slightly stained; polyester and triacetate unstained Suitable for crease-resist finishes (light fastness slightly improved)		**NOTES**

C.I. Reactive Blue	31	32	33
CHEMICAL CLASS	Azo	Anthraquinone	Azo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Bright Reddish Blue	Bright Greenish Blue	Reddish Blue
Artificial light (tungsten)	—	—	—
DYEING			
Cellulose, Nylon, Silk, Wool	Suitable for these fibres	Suitable for these fibres	Suitable for these fibres
PRINTING			
FASTNESS PROPERTIES			
Fibre	Cotton*	Cotton*	Cotton*
Method	ISO	ISO	ISO
	4 (redder)	4–5	4 (yellower)
Alkali	—	—	—
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	3–4	6–7	5–6
normal	—	—	—
2× normal	—	—	—
Peroxide Bleach — Alteration	—	—	—
Staining	4	5	5
Perspiration — Alteration	5	5	4–5
Staining	—	—	—
Soda Boil — Alteration	—	—	—
Staining	4–5 (95°C)	4–5 (95°C)	5 (95°C)
Washing — Alteration	5	5	5
Staining			
OTHER PROPERTIES			
Dischargeability	Moderate (wool)	Moderate (wool)	Poor (wool)
Effect of Metals — Copper	—	—	—
Iron	—	—	—
Reactions in Substance			
H_2SO_4 conc.	—	—	—
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE			
NOTES	Solubility in water: 35 g/l Suitable for crease-resist finishes (reduced light fastness) *Fastness on silk: light 2, washing (60°C) 5, 5; on wool and nylon: light 3	Solubility in water: 25 g/l Suitable for crease-resist finishes (usually no reduction in light fastness) *Fastness on silk: light 5–6, washing (60°C) 4–5, 5; on nylon and wool: light 6	Solubility in water: 100 g/l Suitable for crease-resist finishes (reduced light fastness) *Fastness on silk: light 4, washing (60°C) 4–5, 5; on nylon: light 2; on wool : light 3

34	35	36	C.I. Reactive Blue
Disazo	Phthalocyanine	Anthraquinone	**CHEMICAL CLASS**
—	—	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Navy	Bright Greenish Blue	Blue	**HUE** Daylight
—	—	—	Artificial light (tungsten)
Exhaustion or cold pad-batch process	Alkaline pad liquor containing urea; one-bath pad-steam or heat fixation*	—	**DYEING** Cellulose
—	—	Thermofix method	Nylon
—	—	—	Silk
—	—	—	Wool
	Cellulose: alkaline paste containing urea and special assistant, thickened with alginate; dried and fixed with neutral steam		**PRINTING**
Cotton ISO / Viscose ISO	Cotton ISO	Nylon ISO	**FASTNESS PROPERTIES** Fibre Method
3 / 4	—	—	Alkali
— / —	—	—	Burnt Gas Fumes
— / —	—	—	Carbonising — Alkaline rinse
— / —	—	—	Neutral rinse
— / —	—	—	Decatising
4 / 5–6	5–6	—	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
5–6 / 6	6	4–5	normal
— / —	—	—	2× normal
1 / 1	4–5	—	Peroxide Bleach — Alteration
3–4 / 3	5	—	Staining
4 (acid or alk) / 4–5 (acid or alk)	5 (alkaline)	4–5	Perspiration — Alteration
5 / 5	4–5	4–5	Staining
1 / 1	—	—	Soda Boil — Alteration
4 / 4	—	—	Staining
3–4 (95°C) / 4 (95°C)	4–5	2 (Test 3)	Washing — Alteration
3–4 / 3–4	5	4	Staining
To white (alk) at 20 g dye per l	—		**OTHER PROPERTIES** Dischargeability
—	—		Effect of Metals — Copper
—	—		Iron
—	Yellowish green; on dilution—blue		Reactions in Substance H_2SO_4 conc.
—	—		Dilute HCl
—	Weaker		Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: >100 g/l Suitable for PVC coating Crease-resist finishes: hue unchanged or somewhat greener; light fastness unchanged or somewhat inferior	Solubility in water: 100 g/l Suitable for crease-resist finishes *This dye does not react directly with the fibre, but requires the use of a fixing agent		**NOTES**

C.I. Reactive Blue	37*	38	39
CHEMICAL CLASS	Anthraquinone	Phthalocyanine	Azo
REACTIVE SYSTEM	—	—	Monochlorotriazinyl
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Reddish Blue	Greenish Blue	Blue
Artificial light (tungsten)	—	Greener	Greener
DYEING			
Cellulose	—	Padding processes; fixed with Na_3PO_4 at 60°C or Na_2CO_3 at 80°C	Exhaustion or pad-fix
Nylon	—	—	—
Silk	—	—	—
Wool	—	—	Not recommended
PRINTING	Cellulose: with Na_2CO_3 (or NaOH); fixation by steam or dry heat (The use of $NaHCO_3$ causes precipitation)		Not recommended
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	5	4 (greener)	4 (greener)
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	6	6–7	5–6
normal	6–7	7	6
2× normal	7	—	—
Peroxide Bleach — Alteration	—	—	2
Staining	—	—	4–5
Perspiration — Alteration	4–5	4 (acid)	4–5
Staining	5	5	4–5
Soda Boil — Alteration	—	—	3–4 (greener)
Staining	—	—	3–4
Washing — Alteration	3–4	5 (60°C)	4–5 (severe)
Staining	3	4–5	5
OTHER PROPERTIES			
Dischargeability		Fair (pale dyeings)	Not dischargeable
Effect of Metals — Copper		—	4–5
Iron		—	—
Reactions in Substance			
H_2SO_4 conc.		—	Reddish blue
Dilute HCl		—	Blue
Dilute NaOH		—	Royal blue
NON-TEXTILE USAGE			
NOTES	*This C.I. Generic Name is discontinued. The information given here relates to the dyes formerly listed under it and now listed under C.I. Reactive Blue 19:1 (p.3499)	Solubility in water: 120 g/l at 100°C Effect threads: acetate and nylon stained, polyester and triacetate unstained Suitable for crease-resist finishes (light fastness slightly reduced)	Solubility in water: 80–100 g/l Effect threads: acetate, acrylic and polyester unstained; nylon stained Suitable for crease-resist finishes (greener). Not suitable for goods to be rubberised. Does not migrate in PVC

40	41	42	C.I. Reactive Blue
Azo	Copper phthalocyanine	Anthraquinone	**CHEMICAL CLASS**
Monochlorotriazinyl	Monochlorotriazinyl	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Reddish Navy	Greenish Blue	Blue	**HUE** Daylight
Redder	Greener	Greener	Artificial light (tungsten)
Batchwise, exhaustion or pad-fix methods	Batchwise, exhaustion or pad-fix methods	Exhaustion dyeing (Na_2SO_4 or $NaCl + Na_2CO_3$ or Na_3PO_4)	**DYEING** Cellulose
—	—	—	Nylon
—	—	—	Silk
Not recommended	Not recommended	—	Wool
Not recommended	Not recommended		**PRINTING**
Cotton ISO	Cotton ISO	Cotton ISO / Viscose ISO	**FASTNESS PROPERTIES** Fibre / Method
3–4 (greener)	3–4 (greener)	4–5 / 4	Alkali
—	—	— / —	Burnt Gas Fumes
—	—	— / —	Carbonising — Alkaline rinse
—	—	— / —	Neutral rinse
—	—	— / —	Decatising
4–5	5–6	6 / 6–7	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
5–6	6–7	6 / 7	normal
6–7	—	— / —	2× normal
2	2	— / —	Peroxide Bleach — Alteration
4	3–4	— / —	Staining
4–5	4–5	4–5 (AATCC) / 5 (alk) (AATCC)	Perspiration — Alteration
4	4–5	5 / 4–5	Staining
3–4	3–4 (greener)	— / —	Soda Boil — Alteration
3–4	2–3	— / —	Staining
4–5 (severe)	4 (greener)	5 (95°C) / 4	Washing — Alteration
4–5	3–4	5 / 5	Staining
Not dischargeable	Not dischargeable	2	**OTHER PROPERTIES** Dischargeability
5	4 (greener)	—	Effect of Metals — Copper
4–5	4 (greener)	—	Iron
Greenish blue	Yellowish green	—	Reactions in Substance H_2SO_4 conc.
Bluish red	Bluish green	—	Dilute HCl
Royal blue	Greenish blue	—	Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: 100 g/l Effect threads: acetate (matt), acrylic and nylon slightly stained, polyester and triacetate unstained Suitable for crease-resist finishes	Solubility in water: 50 g/l Effect threads: acetate and polyester unstained, nylon slightly stained Good coverage of dead cotton Crease resist finishes: becomes phototropic; hue changes to violet on exposure to light Suitable for goods to be rubberised	Solubility in water: 20, 40 g/l at 30° and 90°C respectively Poor coverage of dead cotton Suitable for crease-resist finishes	**NOTES**

C.I. Reactive Blue	43		44	45
CHEMICAL CLASS	Monoazo (metal complex)		Anthraquinone	Azo (metal complex)
REACTIVE SYSTEM	—		—	—
C.I. CONSTITUTION NO.	—		—	—
HUE				
Daylight	Navy		Blue	Navy
Artificial light (tungsten)	Duller, redder		—	—
DYEING				
Cellulose	Continuous processes; fixation by steaming or dry heat		Cold pad-batch, pad-steam, pad-thermofix or exhaustion method	
Nylon	—		—	
Silk	—		—	
Wool	—		—	
PRINTING			Cellulose: fixed by neutral steam at 101–103°C Good stability in printing paste	Cellulose: steam or thermofix process Printing paste is stable for more than 30 days
FASTNESS PROPERTIES				
Fibre	Mercerised cotton	Spun viscose	Cotton	Cotton
Method	ISO	ISO	ISO	ISO
Alkali	5	4–5	3–4	4
Burnt Gas Fumes	—	—	—	—
Carbonising — Alkaline rinse	—	—	—	—
Neutral rinse	—	—	—	—
Decatising	—	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	—	5–6	5–6
normal	7–8 (navy)	8 (navy)	5–6	6
2× normal	—	—	—	6–7
Peroxide Bleach — Alteration	—	—	3–4*	4–5 (wash, 95°C)
Staining	—	—	4–5	5
Perspiration — Alteration	4–5 (AATCC) (acid)	4 (AATCC) (acid)	4–5	4–5
Staining	3	3	5	4–5
Soda Boil — Alteration	—	—	2	—
Staining	—	—	4	—
Washing — Alteration	5 (95°C)	5 (95°C)	4–5 (95°C)	5
Staining	5	5	5	5
OTHER PROPERTIES				
Dischargeability	2 (neutral or alkaline)		Not dischargeable	Unsuitable for discharge
Effect of Metals — Copper	—		—	—
Iron	—		—	—
Reactions in Substance				
H_2SO_4 conc.	—		—	—
Dilute HCl	—		—	—
Dilute NaOH	—		—	—
NON-TEXTILE USAGE				
NOTES	Solubility in water: >100 g/l at 30°C. Good stability in hard water Crease-resist finishes: hue unchanged or trace redder; light fastness unchanged or little affected		Suitable for crease-resist finishes; slight change in hue and reduction of light fastness *On printed cotton	Solubility in water: 150 g/l at 50°C Suitable for crease-resist finishes

46	47	48	C.I. Reactive Blue
Anthraquinone	Anthraquinone	Phthalocyanine	**CHEMICAL CLASS**
—	—	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Greenish Blue	Bright Greenish Blue	Bright Greenish Blue	**HUE** Daylight
Greener	Redder	Yellower	Artificial light (tungsten)
4 (a, b), 5 (a, b), 6 (a, b, c)	Suitable		**DYEING** Cellulose
—	—		Nylon
—	—		Silk
—	Weakly acid		Wool
Cellulose; steaming, dry heat, high-temperature steaming, flash-age (2-phase) and wet development methods Printing on C.I. Azoic Coupling Components 2 and 5*	Cellulose: direct, with $NaHCO_3$, fixed by steaming	Cellulose: direct with $NaHCO_3$, fixed by steaming	**PRINTING**
Cotton ISO	Cellulose ISO	Cellulose ISO	**FASTNESS PROPERTIES** Fibre Method
4	4	3–4 (yellower)	Alkali
1	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
6	4–5	5–6	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
6–7	5–6	6	normal
6–7	—	—	2× normal
4–5	4–5	2–3	Peroxide Bleach — Alteration
5	—	—	Staining
4–5	—	—	Perspiration — Alteration
4–5	—	—	Staining
3–4	—	—	Soda Boil — Alteration
4–5	—	—	Staining
4 (ISO 5)	4–5 (60°C)	4–5 (60°C)	Washing — Alteration
5	—	—	Staining
Moderate–poor	Poor (neutral and alkaline)	Poor (neutral and alkaline)	**OTHER PROPERTIES** Dischargeability
4	Greener, duller	Slightly greener	Effect of Metals — Copper
3–4	Greener, duller	Slightly greener	Iron
—	Greenish blue	Green	Reactions in Substance H_2SO_4 conc.
—	Violet	Green, with ppt	Dilute HCl
—	Unchanged	Weaker	Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: >200 g/l at 50°C, 180 g/l with 30 g/l salt Suitable for crease-resist finishes; hue redder, light fastness lower *Suitable for printing on silk and chlorinated wool	Solubility in water: good Suitable for crease-resist finishes (redder)	Solubility in water: very good Suitable for crease-resist finishes	**NOTES**

C.I. Reactive Blue	49	50	51
CHEMICAL CLASS	Anthraquinone	Anthraquinone	Monoazo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Reddish Blue	Reddish Blue	Reddish Blue
Artificial light (tungsten)	Redder	Redder	Redder
DYEING			
Cellulose	4 (a, b), 5 (a, b), 6 (a, b, c)	—	Cold pad-batch method
Nylon	—	—	—
Silk	—	—	—
Wool	—	Exhaustion method	—
PRINTING	Direct on cellulose, silk and wool: fixed by steam or dry heat	On wool, silk or unions	Cellulose: fixation by neutral steam at 101–103°C or baking Paste is stable for 28 days May be printed on naphtholated ground or with vat dyes*
FASTNESS PROPERTIES			
Fibre	Cotton	Wool	Cotton
Method	ISO	ISO	ISO
Alkali	4–5	—	—
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	5–6	5–6	3–4
normal	6	6	5
2× normal	—	6–7	6
Peroxide Bleach — Alteration	4–5	—	3 (wash)
Staining	5	—	4–5
Perspiration — Alteration	—	—	4–5
Staining	—	—	4
Soda Boil — Alteration	—	—	1
Staining	—	—	3–4
Washing — Alteration	4–5 (ISO 4)	4–5 (ISO 3)	3–4
Staining	5	5	4–5
OTHER PROPERTIES			
Dischargeability	Not dischargeable	Not dischargeable	Not dischargeable to white
Effect of Metals — Copper	—	4 (greener, duller)	—
Iron	—	5	—
Reactions in Substance			
H_2SO_4 conc.	Reddish blue	—	—
Dilute HCl	Bluish red	—	—
Dilute NaOH	Blue	—	—
NON-TEXTILE USAGE			
NOTES	Solubility in water: very good Triacetate slightly stained, acetate, acrylic, nylon and polyester unstained	Solubility in water: very good Good wet fastness on chlorinated wool	Suitable for PVC coating and crease-resist finishes *May be overprinted with caustic alkali

52	53	C.I. Reactive Blue
Disazo (formazan metal complex)	Anthraquinone	**CHEMICAL CLASS**
—	—	**REACTIVE SYSTEM**
—	—	**C.I. CONSTITUTION NO.**
Blue	Blue	**HUE** Daylight
Redder, duller	Greener	Artificial light (tungsten)
Exhaustion dyeing (Na_2SO_4 or NaCl+ Na_2CO_3 or Na_3PO_4)	Pad-fix processes, or applied from a hot neutral salt or Na_2SO_4 bath; fixed with strong alkali	**DYEING** Cellulose
—	Acid bath	Nylon
—	With salt+Na_3PO_4	Silk
—	Acid+cationic assistant	Wool
	Cellulose: direct with soda ash, urea, a reduction inhibitor and alginate or emulsion thickening; fixed by steaming	**PRINTING**
Cotton	Cotton	**FASTNESS PROPERTIES** Fibre
ISO	ISO	Method
5	—	Alkali
—	—	Burnt Gas Fumes
—	—	Carbonising — Alkaline rinse
—	—	Neutral rinse
—	—	Decatising
6–7	6–7	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
6–7	7	normal
—	—	2× normal
4	4–5	Peroxide Bleach — Alteration
—	5	Staining
5	—	Perspiration — Alteration
5	—	Staining
2–3 (weaker)*	—	Soda Boil — Alteration
—	—	Staining
4–5 (ISO 5)	4–5	Washing — Alteration
4	5	Staining
Neutral 2–3; alkaline 2	Not dischargeable	**OTHER PROPERTIES** Dischargeability
—	—	Effect of Metals — Copper
—	—	Iron
—	Red-brown	Reactions in Substance
—	No change	H_2SO_4 conc.
—	No change	Dilute HCl
		Dilute NaOH
		NON-TEXTILE USAGE
Solubility in water: 100 g/l at 90°C, 90 g/l at 40°C Good stability in hard water Resin finishes: little effect on hue and light fastness *With oxidising agent, 4	Solubility in water: good	**NOTES**

C.I. Reactive Blue	54	55	56
CHEMICAL CLASS	Azo	Anthraquinone	Azo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Greenish Blue	Bright Blue	Blue
Artificial light (tungsten)	Redder	—	—
DYEING			
Cellulose	Pad-cure* and one-bath pad-steam methods	1 (a, b, c), 2 (a, b), 3 (a, b, c)	1 (a, b, c), 2 (a, b), 3 (a, b, c)
Nylon	—	Suitable	Suitable
Silk	—		
Wool	—		
PRINTING	Cellulose: prints fixed by neutral steaming. Print paste is stable for more than 28 days. Suitable for over-printing with caustic alkali	Direct on cellulose, nylon, silk and wool	Direct on cellulose, nylon, silk and wool
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	4–5	—	—
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	6	—	—
normal	6–7	6	3
2× normal	—	—	—
Peroxide Bleach — Alteration	1	—	—
Staining	5	—	—
Perspiration — Alteration	4–5	4	4
Staining	5	—	—
Soda Boil — Alteration	4 (redder)	—	—
Staining	5	—	—
Washing — Alteration	5 (95°C)	4 (5×95°C)	4 (5×95°C)
Staining	5	—	—
OTHER PROPERTIES			
Dischargeability		Poor	Moderate
Effect of Metals — Copper		—	—
Iron		—	—
Reactions in Substance			
H_2SO_4 conc.		—	—
Dilute HCl		—	—
Dilute NaOH		—	—
NON-TEXTILE USAGE			
NOTES	Solubility in water: 25 g/l at 25°C; with urea and soda ash rises to 70 g/l Crease-resist finishes: some change in hue and loss of light fastness *On viscose the pad-cure method is suitable for pale dyeings only	Solubility in water: very good	Solubility in water: good

57	58	59	C.I. Reactive Blue
Phthalocyanine	Phthalocyanine	Azo	**CHEMICAL CLASS**
—	—	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Greenish Blue	Greenish Blue	Reddish Navy	**HUE** Daylight
—	—	—	Artificial light (tungsten)
Batchwise, pad-development and continuous methods Suitable	Batchwise, pad-development and continuous methods Suitable	Batchwise, pad-development and continuous methods Suitable	**DYEING** Cellulose Nylon Silk Wool
Direct on cellulose, nylon, silk and wool	Direct on cellulose, nylon, silk and wool	Direct on cellulose, nylon, silk and wool	**PRINTING**
Cotton ISO — — — — — — 4–5 — — — 4 — — — 3 (5 × 95°C) —	Cotton ISO — — — — — — 4–5 — — — 3–4 — — — 3 (5 × 95°C) —	Cotton ISO — — — — — 3–4 — — — — 4 — — — 3 (4 × 95°C) —	**FASTNESS PROPERTIES** Fibre Method Alkali Burnt Gas Fumes Carbonising — Alkaline rinse Neutral rinse Decatising Light — $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2 × normal Peroxide Bleach — Alteration Staining Perspiration — Alteration Staining Soda Boil — Alteration Staining Washing — Alteration Staining
Poor — — — — —	Poor — — — — — —	Poor — — — — — —	**OTHER PROPERTIES** Dischargeability Effect of Metals — Copper Iron Reactions in Substance H_2SO_4 conc. Dilute HCl Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: good	Solubility in water: very good	Solubility in water: good	**NOTES**

C.I. Reactive Blue	60	61	62
CHEMICAL CLASS	Azo (metal complex)	Anthraquinone	Azo (1:2 cobalt complex)
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Navy	Blue	Navy
Artificial light (tungsten)	Redder	Redder	Redder
DYEING			
Cellulose	—	One-bath pad-steam and thermofixation processes*	One-bath pad-steam and thermofixation processes*
Nylon	—	Suitable	—
Silk	—	—	—
Wool	pH 6, 70°C, liquor ratio 35:1	—	—
PRINTING		Cotton: hot air, two-phase printing process and rapid steaming process. Suitable for printing on spun rayon and nylon. Unsuitable for overprinting with caustic alkali	Cotton: hot air, two-phase printing process and rapid steaming process. Paste is stable for 4 weeks. Unsuitable for overprinting with caustic alkali
FASTNESS PROPERTIES			
Fibre	Wool	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	—	—	—
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	5	—	—
Neutral rinse	4–5 (redder)	—	—
Decatising	5	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	5–6	5–6	5
normal	6–7	5–6	5–6
2× normal	7	—	—
Peroxide Bleach — Alteration	5	4	4
Staining	5	5	5
Perspiration — Alteration	5	4–5	4–5
Staining	5	5	4–5
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	4–5 (ISO3)	4–5 (ISO4)	4–5 (ISO4)
Staining	5	5	4–5
OTHER PROPERTIES			
Dischargeability	—	Difficult to discharge	Difficult to discharge
Effect of Metals — Copper	4	—	—
Iron	4–5	—	—
Reactions in Substance			
H_2SO_4 conc.	—	—	—
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE	Clothing leathers		
NOTES	Solubility in water: 150 g/l at 90°C Effects: acetate 3–4, cotton 4, nylon 1, polyester 4, silk 2, viscose 4	Solubility: 85 g/kg paste The printing paste is stable for 4 weeks Suitable for PVC coating *This dye does not react directly with the fibre, but requires the use of a fixing agent	Solubility: 85 g/kg paste Suitable for PVC coating *This dye does not react directly with the fibre, but requires the use of a fixing agent

63	64	C.I. Reactive Blue
Phthalocyanine	Monoazo (metallised)	**CHEMICAL CLASS**
—	—	**REACTIVE SYSTEM**
—	—	**C.I. CONSTITUTION NO.**
Greenish Blue	Reddish Blue	**HUE** Daylight
Lighter, greener	Redder	Artificial light (tungsten)
	Batchwise, pad (alkali)-batch (cold), pad-thermofix above 160°C	**DYEING** Cellulose
	—	Nylon
	—	Silk
	—	Wool
Cellulose: steaming, dry heat, high-temperature steaming, flash-age (two-phase) and wet development processes. Printing on C.I. Azoic Coupling Components 2 and 5*		**PRINTING**
Cotton ISO	Cotton ISO	**FASTNESS PROPERTIES** Fibre Method
5	—	Alkali
5	2–3 (weaker, redder)	Burnt Gas Fumes
—	—	Carbonising — Alkaline rinse
—	—	Neutral rinse
—	—	Decatising
—	5	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
6	5–6	normal
6–7	6	2× normal
—	—	Peroxide Bleach — Alteration
—	—	Staining
5	4–5	Perspiration — Alteration
5	4–5	Staining
—	2–3	Soda Boil — Alteration
—	5	Staining
4 (ISO4)	4–5 (ISO4)	Washing — Alteration
4–5	5	Staining
Poor (alkaline and neutral)	$\frac{1}{25}$ Good, $\frac{1}{1}$ fairly good (neutral and alkaline)	**OTHER PROPERTIES** Dischargeability
—	5	Effect of Metals — Copper
—	4 (duller)	Iron
		Reactions in Substance
—	—	H_2SO_4 conc.
—	—	Dilute HCl
—	—	Dilute NaOH
		NON-TEXTILE USAGE
*Suitable for printing on silk	Solubility in water: 40 g/l at 20°, 65 g/l at 65°C	**NOTES**

C.I. Reactive Blue	65	66	67
CHEMICAL CLASS	Azo	Anthraquinone	Azo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Reddish Blue	Blue	Reddish Navy
Artificial light (tungsten)	—	—	—
DYEING			
Cellulose	Pad-cure and one-bath pad-steam methods	Pad-cure and one-bath pad-steam methods	Pad-cure and one-bath pad-steam methods
Nylon	—	—	—
Silk	—	—	—
Wool	—	—	—
PRINTING	Neutral steam. Paste is stable at 20°C for more than 28 days Suitable for overprinting with caustic alkali	Neutral steam. Paste is stable at 20°C for more than 28 days Suitable for overprinting with caustic alkali	Neutral steam. Paste is stable at 20°C for more than 28 days Suitable for overprinting with caustic alkali
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	4	4–5	3–4 (yellower)
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	5	6	6
normal	6	6	6–7
2× normal	—	—	—
Peroxide Bleach — Alteration	1	4–5	2
Staining	5	5	5
Perspiration — Alteration	3 (yellower) (alkaline)	4–5 (alkaline)	3 (yellower)
Staining	5	5	5
Soda Boil — Alteration	4	4–5	4 (yellower)
Staining	4–5	5	5
Washing — Alteration	5 (95°C)	5 (at boil)	4–5 (once at boil)
Staining	5	5	5
OTHER PROPERTIES			
Dischargeability	Unsuitable for white discharges	Unsuitable for white discharges	Unsuitable for white discharges
Effect of Metals — Copper	—	—	—
Iron	—	—	—
Reactions in Substance			
H_2SO_4 conc.	—	—	—
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE			
NOTES	Solubility in water: 50 g/l	Solubility in water: >100 g/l	Solubility in water: >100 g/l

68	69	C.I. Reactive Blue
Anthraquinone	Anthraquinone	**CHEMICAL CLASS**
—	—	**REACTIVE SYSTEM**
—	—	**C.I. CONSTITUTION NO.**
Blue	Bright Blue	**HUE** Daylight
Redder	—	Artificial light (tungsten)
With $Na_2SO_4+Na_2CO_3$ at 40°C, or by cold pad-batch process	—	**DYEING** Cellulose
—	—	Nylon
—	—	Silk
—	Suitable	Wool
Cellulose: fixation by steam at atmospheric pressure. Paste is stable for at least 28 days	Wool and silk	**PRINTING**
Cotton AATCC	Wool ISO	**FASTNESS PROPERTIES** Fibre Method
4–5	3–4 (yellower)	Alkali
—	—	Burnt Gas Fumes
—	—	Carbonising — Alkaline rinse
—	—	Neutral rinse
—	—	Decatising
5–6	5–6	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
5–6	6	normal
5–6	6–7	2× normal
2	5	Peroxide Bleach — Alteration
4–5	4–5	Staining
5	—	Perspiration — Alteration
5	—	Staining
3–4	—	Soda Boil — Alteration
1–2	—	Staining
4–5 (ISO4)	5 (50°C)	Washing — Alteration
5	5	Staining
Not dischargeable	Not dischargeable	**OTHER PROPERTIES** Dischargeability
—	4 (yellower, duller)	Effect of Metals — Copper
—	4–5	Iron
		Reactions in Substance
—	Bluish violet; on dilution—reddish blue	H_2SO_4 conc.
—	Greenish blue	Dilute HCl
—	Greenish blue	Dilute NaOH
		NON-TEXTILE USAGE
Solubility in water: good Suitable for crease-resist finishes; some change in hue and loss of light fastness Effects: nylon stained, acetate, acrylic, polyester and triacetate unstained	Solubility in water: very good; not sensitive to hard water Mainly for wool; suitable for wool treated by an oxidative anti-shrink process —	**NOTES**

C.I. Reactive Blue	70	71	72
CHEMICAL CLASS	Disazo (formazan copper complex)	Phthalocyanine	Phthalocyanine
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Greenish blue	Greenish Blue	Bright Greenish Blue
Artificial light (tungsten)	Slightly greener, weaker	Yellower	—
DYEING			
Cellulose	Exhaustion, pad-batch and continuous methods	Pad (alkali)-batch, pad-thermofix or pad-dry-steam processes	Application possible, but no special advantage
Nylon	—	—	—
Silk	—	—	—
Wool	—	—	—
PRINTING		Cellulose: steaming, dry heat, high-temperature steaming and flash-age (2-phase) processes. Printing on C.I. Azoic Coupling Components 2 and 5. For printing on silk and chlorinated wool	Mainly for printing on cellulose and wool
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cellulose
Method	ISO	ISO	ISO
Alkali	3–4	5	3–4
Burnt Gas Fumes	—	4–5	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	6–7	4–5	5–6
normal	6–7	6	6
2× normal	—	6	—
Peroxide Bleach — Alteration	4–5	2 (weaker, greener)	1–2
Staining	—	3	—
Perspiration — Alteration	4	4 (redder)	—
Staining	5	4–5	—
Soda Boil — Alteration	—	3	—
Staining	—	3	—
Washing — Alteration	4–5 (ISO4)	4 (ISO4)	4 (ISO4)
Staining	4–5	4	—
OTHER PROPERTIES			
Dischargeability		Not very good	Poor
Effect of Metals — Copper		5	—
Iron		3 (greener, duller)	—
Reactions in Substance			
H_2SO_4 conc.		—	Green*
Dilute HCl		—	Greenish blue
Dilute NaOH		—	—
NON-TEXTILE USAGE			
NOTES	Good stability in hard water Suitable for PVC coating	Solubility in water: 90 g/l at 20°C, 110 g/l at 50°C Staining: acrylic (modified or unmodified) 2, acetate 2, triacetate 2–3, nylon 2, polyester 3, wool 1	Solubility in water: very good *On dilution–greenish blue

73	74	75	C.I. Reactive Blue
Disazo	Anthraquinone	Anthraquinone	**CHEMICAL CLASS**
—	—	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Reddish Navy	Bright Blue	Bright Blue	**HUE** Daylight
—	—	—	Artificial light (tungsten)
Exhaustion method with Na_2SO_4	Application possible, without advantages	Application possible, without advantages	**DYEING** Cellulose
—	—	—	Nylon
—	—	—	Silk
—	—	—	Wool
	Mainly for printing on cellulose, chlorinated wool and unions, by one- and two-step fixation methods	Mainly for printing on cellulose, chlorinated wool and unions by one- and two-step fixation methods	**PRINTING**
Cotton ISO	Cellulose ISO	Cellulose ISO	**FASTNESS PROPERTIES** Fibre Method
3 (yellower)	4–5	3–4	Alkali
—	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
6	6	5–6	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
6	6–7	6	normal
—	—	—	2× normal
2	4–5	1–2	Peroxide Bleach — Alteration
4	—	—	Staining
4–5	—	—	Perspiration — Alteration
4–5	—	—	Staining
1	—	—	Soda Boil — Alteration
3	—	—	Staining
4–5 (59°C)	4–5 (ISO)	4 (ISO4)	Washing — Alteration
4–5	—	—	Staining
Good	Poor	Poor (neutral and alkaline)	**OTHER PROPERTIES** Dischargeability
—	—	—	Effect of Metals — Copper
—	—	—	Iron
—	—	Green; on diln—greenish blue	Reactions in Substance
—	—	Greenish blue	H_2SO_4 conc.
—	—	—	Dilute HCl
			Dilute NaOH
			NON-TEXTILE USAGE
Effect threads: cellulose stained; acetate, acrylic, nylon, polyester and triacetate unstained	Solubility in water: very good	Solubility in water: very good Suitable for crease-resist finishes	**NOTES**

C.I. Reactive Blue	76	77	78
CHEMICAL CLASS	Disazo	Phthalocyanine	Azo (metal complex)
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Reddish Navy	Greenish Blue	Navy
Artificial light (tungsten)	Redder and duller	Greener	Redder
DYEING			
Cellulose	Padded with $NaHCO_3$ and urea; fixed by steaming or dry heat	Exhaustion processes (60°C)	Exhaustion dyeing (winch or jigger)
Nylon	—	—	—
Silk	—	—	—
Wool	—	—	—
PRINTING	Cellulose: with $NaHCO_3$ and a neutral alginate thickener; fixation by neutral steaming	Cellulose: with $NaHCO_3$ and a neutral alginate thickener; fixed by neutral steaming	
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	5	3 (greener)	4 (Na_2CO_3)
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	3 (redder)	5–6	—
normal	3–4 (redder)	6	6 (redder)
2× normal	4–5 (redder)	—	7 (as navy)
Peroxide Bleach — Alteration	—	—	—
Staining	—	—	—
Perspiration — Alteration	3–4	5	5
Staining	4–5	4–5	4–5
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	3–4 (95°C)	3–4 (95°C)	4–5 (95°C)
Staining	3	4	4
OTHER PROPERTIES			
Dischargeability	Deep dyeings are not dischargeable	Not dischargeable to white	2–3/3–4
Effect of Metals — Copper	—	—	—
Iron	—	—	—
Reactions in Substance			
H_2SO_4 conc.	—	—	—
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE			
NOTES	Solubility in water: good Effect threads: acetate and cellulose stained; nylon slightly stained; acrylic, polyester and triacetate unstained. Unsuitable as a shading component Synthetic resin finishes: marked changes occur	Effect threads: acetate and cellulose highly stained; acrylic and nylon stained; polyester and triacetate unstained Resin finishes: phototropism may occur	Solubility in water: 100 g/l at 30°C. Not sensitive to hard water Crease-resist finishes: slight change in hue; light fastness unchanged

79	80	81	C.I. Reactive Blue
Azo (metal complex)	Phthalocyanine	Monoazo	**CHEMICAL CLASS**
—	—	Dichlorotriazinyl	**REACTIVE SYSTEM**
—	—	**18245**	**C.I. CONSTITUTION NO.**
Navy	Greenish Blue	Reddish Blue	**HUE**
Redder	Greener	—	Daylight Artificial light (tungsten)
Exhaustion process (winch or jigger)	Exhaustion or pad-batch (cold)	Batch dyeing with cationic auxiliaries	**DYEING**
—	—	Suitable	Cellulose
—	—	—	Nylon
—	—	Suitable	Silk Wool
		Two-phase printing process	**PRINTING**
Cotton	Cotton	Cellulose	**FASTNESS PROPERTIES**
ISO	ISO	ISO	Fibre
			Method
4 (Na_2CO_3)	4	—	Alkali
—	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
—	5	—	Light — $\frac{1}{3}$—$\frac{1}{2}$ normal
5 (as blue)	5–6	3–4	normal
6 (as navy)	—	—	2× normal
—	2	—	Peroxide Bleach — Alteration
—	3	—	Staining
5	4–5	—	Perspiration — Alteration
4–5	5	—	Staining
—	2	—	Soda Boil — Alteration
—	2–3	—	Staining
5 (95°C)	4–5 (95°C)	4–5	Washing — Alteration
4–5	4	—	Staining
3/3–4	Poor	Very good (neutral)	**OTHER PROPERTIES**
—	—	—	Dischargeability
—	—	—	Effect of Metals — Copper
			Iron
—	—	—	Reactions in Substance
—	—	—	H_2SO_4 conc.
—	—	—	Dilute HCl
—	—	—	Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: 100 g/l at 30°C. Not sensitive to hard water Crease-resist finishes: slight hue change on viscose, none on cotton; slight loss of light fastness	Staining: acetate and nylon slightly stained; acrylic, polyester and triacetate unstained Crease-resist finishes: suitable; some change in hue and loss of light fastness, and may become phototropic	Solubility in water: very good; sensitive to hard water Suitable for crease-resist finishes	**NOTES**

C.I. Reactive Blue 82—87

C.I. Reactive Blue	82	83	84
CHEMICAL CLASS	Azo	Formazan (copper complex)	Formazan (Cu-complex)
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Navy	Blue	Reddish Blue
Artificial light (tungsten)	Redder, duller	Much greener	Much redder
DYEING			
Cellulose	Batchwise, pad-batch and continuous processes		
Nylon	—		
Silk	—		
Wool	—		
PRINTING		Pad-steam or pad-(alkali shock) processes	Pad-steam or pad-(alkali shock) processes
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	4 (greener)	3 (greener)	2–3 (greener)
Burnt Gas Fumes	—	3–4 (3 cycles)	2 (greener, weaker, 3 cycles)
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — ¼–½ normal	—	6	6
normal	6	6–7	6–7
2× normal	6	—	—
Peroxide Bleach — Alteration	2	—	—
Staining	3–4	—	—
Perspiration — Alteration	4–5	3 (greener)	3 (greener)
Staining	5	4	4–5
Soda Boil — Alteration	3–4 (duller)	—	—
Staining	5	—	—
Washing — Alteration	4 (greener)	3 (weaker)	2–3 (weaker)
Staining	4–5	4	5
OTHER PROPERTIES			
Dischargeability	Dischargeable to white in pale dyeings*	Neutral 2–3; alkaline 2	Neutral 2–3; alkaline 2
Effect of Metals — Copper	No change	—	—
Iron	No change	—	—
Reactions in Substance			
H_2SO_4 conc.	—	—	—
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE			
NOTES	Solubility in water: good; not sensitive to hard water Suitable for crease-resist finishes; hue becomes weaker and redder Metal-sequestering agents based on ethylenediaminetetraacetic acid should be avoided *Coloured discharges are obtainable from heavy dyeings in neutral or alkaline conditions	Stripping: hydrosulphite, marked strip and/or considerable alteration; hypochlorite, very effective	Stripping: hydrosulphite, marked strip and/or considerable alteration; hypochlorite, very effective strip

85	86	87	C.I. Reactive Blue
Phthalocyanine	Anthraquinone	Disazo	**CHEMICAL CLASS**
—	—	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Greenish Blue	Blue	Blue	**HUE** Daylight
Weaker	Slightly brighter	Slightly redder	Artificial light (tungsten)
	Padded on fabric and fixed by dry heat with acid catalyst	Padded on fabric and fixed by dry heat with acid catalyst	**DYEING** Cellulose
	—	—	Nylon
	—	—	Silk
	—	—	Wool
Pad-(alkali shock), pad-dry or pad-batch processes	Printed on cellulosic fabric and fixed by dry heat with acid catalyst	Printed on cellulosic fabric and fixed by dry heat with acid catalyst	**PRINTING**
Cotton ISO	Cotton AATCC	Cotton AATCC	**FASTNESS PROPERTIES** Fibre Method
2 (greener, duller)	—	—	Alkali
1 (greener) (3 cycles)	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
5	—	—	Light — $\frac{1}{3}$—$\frac{1}{2}$ normal
6	—	—	normal
—	—	—	2× normal
—	—	—	Peroxide Bleach — Alteration
—	—	—	Staining
4–5	4–5	4–5	Perspiration — Alteration
3–4	—	—	Staining
—	—	—	Soda Boil — Alteration
—	—	—	Staining
4 (95°C)	4–5	5	Washing — Alteration
4–5	—	—	Staining
Neutral 2–3; alkaline 2			**OTHER PROPERTIES** Dischargeability
—			Effect of Metals — Copper
—			Iron
—			Reactions in Substance
—			H_2SO_4 conc.
—			Dilute HCl
—			Dilute NaOH
			NON-TEXTILE USAGE
Stripping: hydrosulphite—marked strip and/or considerable alteration	Fastness on cotton (AATCC): chlorine 1 Literature: *BP* 1,100,599 McCleary, Cate, Fordemwalt and Loffelman, *Am. Dyestuff Rep.*, 1967, **56**, P46	Fastness on cotton (AATCC): chlorine 4–5 Literature: *BP* 1,100,599 McCleary, Cate, Fordemwalt and Loffelman, *Am. Dyestuff Rep.*, 1967, **56**, P46	**NOTES**

C.I. Reactive Blue	88	89	90
CHEMICAL CLASS	Phthalocyanine	Azo	Azo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Blue	Reddish Navy Blue	Greenish Navy Blue
Artificial light (tungsten)	Very slightly redder	—	—
DYEING			
Cellulose	Padding on fabric and fixed by dry heat with acid catalyst	Padded with $NaHCO_3$ and urea; fixed by steaming or dry heat	Padded with $NaHCO_3$ and urea; fixed by steaming or dry heat
Nylon	—	—	—
Silk	—	—	—
Wool	—	—	—
PRINTING	Printed on cellulosic fabric and fixed by dry heat with acid catalyst	Cellulose	Cellulose
FASTNESS PROPERTIES			
Fibre	Cellulose	Cellulose	Cellulose
Method	AATCC	AATCC	AATCC
Alkali	—	—	—
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — ⅓–½ normal	—	—	—
normal	—	5–6	5
2× normal	—	—	—
Peroxide Bleach — Alteration	—	—	—
Staining	—	—	—
Perspiration — Alteration	4, 3–4 (acid, alkaline)	—	—
Staining	—	—	—
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	—	4–5	4–5 (Test 3)
Staining	—	—	—
OTHER PROPERTIES			
Dischargeability			
Effect of Metals — Copper			
Iron			
Reactions in Substance			
H_2SO_4 conc.			
Dilute HCl			
Dilute NaOH			
NON-TEXTILE USAGE			
NOTES	Fastness on cellulose (AATCC): chlorine 2 Literature: *BP* 1,100,599 McCleary, Cate, Fordemwalt and Loffelman, *Am. Dyestuff Rep.*, 1967, **56**, P46		

91	92	93	C.I. Reactive Blue
Phthalocyanine	Phthalocyanine	Anthraquinone	**CHEMICAL CLASS**
—	Chlorobenzothiazolsulphonyl	Chlorobenzothiazolsulphonyl	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Bright Greenish Blue	Greenish Blue	Blue	**HUE** Daylight
—	Greener	Redder	Artificial light (tungsten)
Padded with $NaHCO_3$ and urea; fixed by steaming or dry heat	Pad-thermofix, pad-roll or pad-jig methods	Pad-thermofix, -batch, -steam, -roll, -jig and exhaustion methods	**DYEING** Cellulose
—	—	—	Nylon
—	—	—	Silk
—	—	—	Wool
Cellulose	Cellulose: printed with urea + $NaHCO_3$ or Na_2CO_3 and fixed by steaming or thermofixation Paste is stable for more than 4 weeks	Cellulose: printed with urea and $NaHCO_3$ or Na_2CO_3 and fixed by steam or thermofixation; flash-age, alkali shock methods (cold or hot) Paste is stable for more than 4 weeks	**PRINTING**
Cellulose AATCC	Cotton ISO	Cotton ISO	**FASTNESS PROPERTIES** Fibre Method
—	4	4–5	Alkali
—	4–5	3	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
—	5	5	Light — $\frac{1}{3}$—$\frac{1}{2}$ normal
4–5	6	5–6	normal
—	—	—	2× normal
—	3–4 (duller)	4–5	Peroxide Bleach — Alteration
—	3	5	Staining
—	5	4–5	Perspiration — Alteration
—	5	4–5	Staining
—	—	—	Soda Boil — Alteration
—	—	—	Staining
5 (Test 3)	4–5 (ISO4)	4–5 (ISO4)	Washing — Alteration
4–5 (Test 4)	4–5	5	Staining
	2 (neutral or alkaline)	1–2 (neutral); 3 (alkaline)	**OTHER PROPERTIES** Dischargeability
	—	—	Effect of Metals — Copper
	—	—	Iron
			Reactions in Substance
	—	—	H_2SO_4 conc.
	—	—	Dilute HCl
	—	—	Dilute NaOH
			NON-TEXTILE USAGE
	Solubility in water: 100 g/l at 90°C	Solubility in water: 200 g/l at 30°C	**NOTES**

C.I. Reactive Blue	94	95	96
CHEMICAL CLASS	Anthraquinone	Phthalocyanine	Azo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Blue	Greenish Blue	Reddish Blue
Artificial light (tungsten)	Greener	—	—
DYEING			
Cellulose	Stained	Pad-thermofix and one-bath pad-steam processes	4 (a, b), 5 (a, b), 6 (a, b, c)
Nylon	Dyed	—	Suitable
Silk	Very heavily stained	—	
Wool	pH 4.5–5; acetic acid + Na_2SO_4 + auxiliary*	—	
PRINTING		Cellulose: neutral steam Paste is stable for more than 28 days at 20°C. Suitable for over-printing with caustic alkali	Cellulose, nylon, silk and wool: as for C.I. Reactive Yellow 2
FASTNESS PROPERTIES			
Fibre	Wool	Cotton	Cellulose
Method	ISO	ISO	ISO
Alkali	4	3	—
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	4–5	—	—
Neutral rinse	4–5	—	—
Decatising	4–5	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	5–6	6	—
normal	6	6–7	6
2× normal	6–7	—	—
Peroxide Bleach — Alteration	4–5	1–2	—
Staining	5	3	—
Perspiration — Alteration	4–5 (acid or alkaline)	4–5 (alkaline)*	4–5
Staining	5	4–5	—
Soda Boil — Alteration	—	2	—
Staining	—	2	—
Washing — Alteration	4 (5×60°C)	4 (90°C, 4 h)	3–4 (5×95°C)
Staining	5	4	—
OTHER PROPERTIES			
Dischargeability	2		Poor
Effect of Metals — Copper	4		—
Iron	4–5		—
Reactions in Substance			
H_2SO_4 conc.	—		—
Dilute HCl	—		—
Dilute NaOH	—		—
NON-TEXTILE USAGE			
NOTES	Solubility in water: 91–100 g/l *May be aftertreated with ammonia for deep dyeings on wool or chlorinated wool	Solubility in water: >100 g/l at 25°C Suitable for PVC coating *Fastness to perspiration (alk) when printed on cotton 5, 3	Solubility in water: good

97	98	99	C.I. Reactive Blue
Azo	Disazo	Anthraquinone	**CHEMICAL CLASS**
—	—	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Bright Blue	Greenish Navy	Blue	**HUE** Daylight
—	—	Redder, duller	Artificial light (tungsten)
4 (a, b), 5 (a, b), 6 (a, b, c) Suitable			**DYEING** Cellulose Nylon Silk Wool
Cellulose, nylon, silk and wool: as for C.I. Reactive Yellow 2	Cellulose: printed with $NaHCO_3$ and steamed; also thermofix, wet development, flash-age and pad-batch methods	Cellulose; steaming, dry heat, high-temperature steaming processes. Suitable for printing on C.I. Coupling Components 2 and 5. For printing on natural silk	**PRINTING**
Cellulose ISO	Cotton ISO	Cotton ISO	**FASTNESS PROPERTIES** Fibre Method
— — — — —	3 — — — —	4–5 (Na_2CO_3) 1 (redder, duller) — — —	Alkali Burnt Gas Fumes Carbonising — Alkaline rinse Neutral rinse Decatising
— 5–6 —	3–4 4–5 —	— 6 6–7	Light — $\frac{1}{3}$—$\frac{1}{2}$ normal normal 2× normal
— — 4 —	— — 4 (acid and alkaline) 5	— — 4–5 5	Peroxide Bleach — Alteration Staining Perspiration — Alteration Staining
— — 4 (5×95°C) —	— — 3 (Test 4) 4–5	— — 4–5 (ISO4) 5	Soda Boil — Alteration Staining Washing — Alteration Staining
Poor — — — —	White and coloured discharges — — — —	Coloured discharges at $\frac{1}{25}$ standard depth — — — —	**OTHER PROPERTIES** Dischargeability Effect of Metals — Copper Iron Reactions in Substance H_2SO_4 conc. Dilute HCl Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: good	Suitable for PVC coating Crease-resist finishes: some loss of light fastness	Solubility in water: very good	**NOTES**

C.I. Reactive Blue	100	101
CHEMICAL CLASS	Monoazo	Anthraquinone
REACTIVE SYSTEM	—	—
C.I. CONSTITUTION NO.	—	—
HUE		
Daylight	Reddish Blue	Blue
Artificial light (tungsten)	—	—
DYEING		
Cellulose	Padded cold with urea+$NaHCO_3$; fixed by steam or dry heat	Padded cold with urea+$NaHCO_3$; fixed by steam or dry heat
Nylon	—	—
Silk	—	—
Wool	—	—
PRINTING	Cellulose: direct processes, print paste containing $NaHCO_3$ and a neutral alginate thickener; fixation by neutral steam	Cellulose: direct processes, print paste containing $NaHCO_3$ and a neutral alginate thickener; fixation by neutral steam
FASTNESS PROPERTIES		
Fibre	Cotton	Cotton
Method	ISO	ISO
Alkali	4	5
Burnt Gas Fumes	—	—
Carbonising — Alkaline rinse	—	—
Neutral rinse	—	—
Decatising	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	—
normal	5	7
2× normal	—	—
Peroxide Bleach — Alteration	—	—
Staining	—	—
Perspiration — Alteration	2–3	5
Staining	5	5
Soda Boil — Alteration	—	—
Staining	—	—
Washing — Alteration	5 (70°C)	5 (70°C)
Staining	5	5
OTHER PROPERTIES		
Dischargeability	Dischargeable to white	Dischargeable to white
Effect of Metals — Copper	—	—
Iron	—	—
Reactions in Substance		
H_2SO_4 conc.	—	—
Dilute HCl	—	—
Dilute NaOH	—	—
NON-TEXTILE USAGE		
NOTES	Solubility in water: good	Solublity in water: good

C.I. Reactive Green 1—3

C.I. Reactive Green	1	2	3
CHEMICAL CLASS	Anthraquinone	Phthalocyanine	Anthraquinone
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Greenish Blue	Bright Green	Olive
Artificial light (tungsten)	—	—	—
DYEING			
Cellulose			
Nylon			
Silk			
Wool			
PRINTING	Cellulose: alkaline paste (alginate or emulsion thickening); fixed by neutral steam or baking	Cellulose: alkaline paste (alginate or emulsion thickening); fixed by neutral steam or baking	Cellulose: alkaline paste (alginate or emulsion thickening); fixed by neutral steam or baking
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	—	—	—
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	3–4	7–8	6
normal	4	7–8	6–7
2× normal	4	—	7
Peroxide Bleach — Alteration	5	4	4
Staining	4–5	4–5	4–5
Perspiration — Alteration	—	—	—
Staining	—	—	—
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	5	5	5
Staining	5	5	5
OTHER PROPERTIES			
Dischargeability	Not dischargeable	Not dischargeable	Not dischargeable
Effect of Metals — Copper	—	—	—
Iron	—	—	—
Reactions in Substance			
H_2SO_4 conc.	Bluish green; on diln—bluish green	Reddish brown; on diln—green	Olive; on diln—olive
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE			
NOTES	Suitable for crease-resist finishes	Suitable for crease-resist finishes	Suitable for crease-resist finishes

C.I. Reactive Green	4	5
CHEMICAL CLASS	Phthalocyanine	Phthalocyanine
REACTIVE SYSTEM	—	—
C.I. CONSTITUTION NO.	—	—
HUE		
Daylight	Bluish Green	Bright Green
Artificial light (tungsten)	—	Yellower
DYEING		
Cellulose	Pad-steam or pad-bake	Pad-jig, pad-roll, pad-steam, thermofix, cold batch or exhaustion methods
Nylon	—	—
Silk	—	—
Wool	—	—
PRINTING	Cellulose: alkaline paste (alginate or emulsion thickening); fixed by neutral steam or baking	Cellulose: steam, bake or alkali shock process
FASTNESS PROPERTIES		
Fibre	Cotton	Cotton
Method	ISO	ISO
Alkali	—	4
Burnt Gas Fumes	—	—
Carbonising — Alkaline rinse	—	—
Neutral rinse	—	—
Decatising	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	7	4
normal	7	5
2× normal	—	—
Peroxide Bleach — Alteration	4	3–4 (bluer)
Staining	3	—
Perspiration — Alteration	—	—
Staining	—	—
Soda Boil — Alteration	—	—
Staining	—	—
Washing — Alteration	5 (ISO4)	4–5
Staining	4–5	4–5
OTHER PROPERTIES		
Dischargeability	Good (alkaline)	Poor
Effect of Metals — Copper	—	—
Iron	—	—
Reactions in Substance		
H_2SO_4 conc.	Green; on dilution—greenish blue	Yellowish green; on dilution—green
Dilute HCl	—	—
Dilute NaOH	—	—
NON-TEXTILE USAGE		
NOTES	Suitable for crease-resist finishes	Solubility in water: very good Suitable for crease-resist finishes

6	7	8	C.I. Reactive Green
Anthraquinone–azo	Anthraquinone	Monoazo	**CHEMICAL CLASS**
—	—	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Olive	Green	Yellowish Olive Green	**HUE** Daylight
Yellower	—	Yellower	Artificial light (tungsten)
1 (a, b, c), 2 (a, b), 3 (a, b, c)	Suitable	Pad-thermofix, pad-jig, single-pad steaming and exhaustion processes	**DYEING** Cellulose
—		—	Nylon
—		—	Silk
—		—	Wool
		Cellulose, silk and wool: fixation by steam or baking	**PRINTING**
Cotton	Cotton*	Cotton	**FASTNESS PROPERTIES** Fibre
ISO	ISO	ISO	Method
4–5	4–5	3–4 (yellower)	Alkali
1*	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
—†	—	5	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
5	5	5–6	normal
5	—	6	2× normal
3–4	—	5	Peroxide Bleach — Alteration
3–4	—	5	Staining
5	5	4–5 (alkaline)	Perspiration — Alteration
4–5	4–5	4–5	Staining
4–5	—	1–2 (bluer, weaker)	Soda Boil — Alteration
4–5	—	—	Staining
5 (100°C)	4 (bluer) (95°C)	5	Washing — Alteration
4–5	4–5	5	Staining
Poor	Moderate (wool)	Not dischargeable	**OTHER PROPERTIES** Dischargeability
5	—	5	Effect of Metals — Copper
4–5	—	4–5	Iron
—	—	Reddish violet*	Reactions in Substance H_2SO_4 conc.
—	—	Brownish olive green	Dilute HCl
—	—	Yellowish brown	Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: 70 g/l at 50°C (10 g/l with 30 g/l salt) Generally suitable for crease-resist finishes; slight change in hue and loss of light fastness *Burnt gas fumes: 4–5 with melamine-formaldehyde after-treatment †Fastness on cotton at $\frac{1}{25}$ normal (ISO): light 4–5	Solubility in water: 180 g/l *Fastness to light on nylon 5–6; on silk 5; on wool 5–6 Fastness to washing at 60°C on silk 5, 5	Solubility in water: very good; not sensitive to hard water Suitable for crease-resist finishes *On dilution—brownish olive green	**NOTES**

C.I. Reactive Green	9	10
CHEMICAL CLASS	Phthalocyanine	Azo
REACTIVE SYSTEM	—	Monochlorotriazinyl
C.I. CONSTITUTION NO.	—	—
HUE		
Daylight	Green	Yellowish Green
Artificial light (tungsten)	—	Yellower
DYEING		
Cellulose	Padded with urea+NaOH and fixed by neutral steam or dry heat	Pad-fix, pad-roll, pad-jig and exhaustion methods
Nylon	—	—
Silk	—	—
Wool	—	—
PRINTING	Cellulose: printed with urea+alkali and fixed by neutral steam or dry heat Stability of printing paste at 20°C: caustic soda recipe 21 days; soda or $NaHCO_3$ recipe >28 days	Cellulose, silk and wool: fixation by steam or baking
FASTNESS PROPERTIES		
Fibre	Cotton / Viscose	Cellulose
Method	ISO / ISO	ISO
Alkali	— / —	3–4 (yellower)
Burnt Gas Fumes	— / —	—
Carbonising — Alkaline rinse	— / —	—
Neutral rinse	— / —	—
Decatising	— / —	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	6 / 6	5–6
normal	6–7 / 7	6
2× normal	— / —	6
Peroxide Bleach — Alteration	4–5 (wash) / 4–5 (wash)	4–5
Staining	4–5 / 5	5
Perspiration — Alteration	5 (acid or alk) / 5 (acid or alk)	—
Staining	5 / 5	—
Soda Boil — Alteration	4–5 / 4–5	—
Staining	4 / 4	—
Washing — Alteration	5 / 4–5	4–5
Staining	4–5 / 5	5
OTHER PROPERTIES		
Dischargeability	Dischargeable to white (pale and medium depths)	Not dischargeable
Effect of Metals — Copper	—	4–5
Iron	—	4–5
Reactions in Substance		
H_2SO_4 conc.	—	Yellowish red; on dilution—dark brown
Dilute HCl	—	Yellowish green
Dilute NaOH	—	Olive
NON-TEXTILE USAGE		
NOTES	Suitable for caustic fall-on styles, PVC coating and crease-resist finishes	Solubility in water: very good; not sensitive to hard water Suitable for crease-resist finishes (hue becomes slightly bluer)

11	12	13	C.I. Reactive Green
Anthraquinone	Phthalocyanine	Phthalocyanine	**CHEMICAL CLASS**
—	—	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Yellowish Green	Bright Yellowish Green	Green	**HUE** Daylight
Yellower	Yellower	—	Artificial light (tungsten)
4 (a, b), 5 (a, b), 6 (a, b, c)	Continuous and exhaustion methods		**DYEING** Cellulose
—	—		Nylon
—	—		Silk
—	—		Wool
	Cellulose: fixation by steam or hot air Stable in printing pastes	Machine printing; one-bath pad-steam process*	**PRINTING**
Cotton ISO	Cotton ISO	Cotton ISO	**FASTNESS PROPERTIES** Fibre Method
4	3	—	Alkali
1–2	5	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
5	4–5	6–7	Light — $\frac{1}{3}$—$\frac{1}{2}$ normal
5	5–6	7	normal
5	—	—	2× normal
4–5	—	4 (wash)	Peroxide Bleach — Alteration
5	—	3	Staining
5	4–5 (acid or alk)	4, 4–5 (acid, alk)	Perspiration — Alteration
4	5	5, 5 (acid, alk)	Staining
4	—	—	Soda Boil — Alteration
5	—	—	Staining
4–5 (ISO5)	3–4 (5×95°C)	4 (ISO4)	Washing — Alteration
5	5	3–4	Staining
Poor	2–3 (neutral); 2 (alkaline)		**OTHER PROPERTIES** Dischargeability
4 (stronger)	—		Effect of Metals — Copper
5	—		Iron
—	—		Reactions in Substance H_2SO_4 conc.
—	—		Dilute HCl
—	—		Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: 50 g/l at 50°C, 20 g/l with 30 g/l salt Suitable for crease-resist finishes; slight hue change and improved fastness to burnt gas fumes	Solubility in water: 100 g/l at 30°C. Good stability to hard water Suitable for crease-resist finishes (hue and light fastness affected by certain treatments) Suitable for PVC coating and vulcanising	*This dye does not react directly with the fibre but requires the use of a fixing agent	**NOTES**

C.I. Reactive Green	14	15	16
CHEMICAL CLASS	Phthalocyanine	Monoazo (formazan) copper complex)	Azo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Green	Green	Dull Bluish Green
Artificial light (tungsten)	Slightly yellower	Yellower, weaker	Greener
DYEING			
Cellulose	Exhaust, one-bath pad-batch, short-time pad-batch and one-bath wet steam methods	Exhaustion method	Exhaustion or pad-batch (cold) method
Nylon	—	—	—
Silk	—	—	—
Wool	—	—	—
PRINTING			
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	3–4 (yellower, duller)	3 (yellower)	4 (greener)
Burnt Gas Fumes	—	3–4 (3 cycles)	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	5	5–6	6
normal	5–6	6–7	6–7
2× normal	—	7	—
Peroxide Bleach — Alteration	—	—	1–2
Staining	—	—	3
Perspiration — Alteration	5	4–5 (acid)	3–4 (greener)
Staining	5	4–5	4–5
Soda Boil — Alteration	—	—	1
Staining	—	—	2
Washing — Alteration	3 (95°C)	5 (95°C)	5
Staining	3–4	4–5	5
OTHER PROPERTIES			
Dischargeability	Dischargeable to white	Neutral 4; alkaline 2–3	Moderate
Effect of Metals — Copper	—	—	—
Iron	—	—	—
Reactions in Substance			
H_2SO_4 conc.	—	—	—
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE			
NOTES	Effect threads: acetate, acrylic, cellulose, nylon, polyester and triacetate stained	Solubility in water: 80 g/l at 90°C. Good stability to hard water Suitable for crease-resist finishes and PVC coating	Effect threads: acetate, acrylic, nylon, polyester and triacetate unstained Crease-resist finishes: slight change in hue and loss of light fastness

17	18		C.I. Reactive Green
Anthraquinone	Phthalocyanine		**CHEMICAL CLASS**
—	—		**REACTIVE SYSTEM**
—	—		**C.I. CONSTITUTION NO.**
Green	Bluish Green		**HUE**
			Daylight
Yellower	—		Artificial light (tungsten)
Suitable	Padded cold with urea + $NaHCO_3$; fixed by steam or dry heat		**DYEING**
			Cellulose
—	—		Nylon
—	—		Silk
—	—		Wool
	Cellulose: direct processes, print paste containing $NaHCO_3$ and a neutral alginate thickener; fixation by neutral steam		**PRINTING**
Cotton	Cotton		**FASTNESS PROPERTIES**
ISO	ISO		Fibre
			Method
4–5	4–5		Alkali
—	—		Burnt Gas Fumes
—	—		Carbonising — Alkaline rinse
—	—		Neutral rinse
—	—		Decatising
6	—		Light — $\frac{1}{3}$—$\frac{1}{2}$ normal
6	5		normal
—	—		2× normal
2	—		Peroxide Bleach — Alteration
3	—		Staining
5 (acid)	5		Perspiration — Alteration
5	5		Staining
2–3	—		Soda Boil — Alteration
2	—		Staining
4–5 (95°C)	5 (70°C)		Washing — Alteration
5	5		Staining
Not dischargeable	Dischargeable to white		**OTHER PROPERTIES**
—	—		Dischargeability
—	—		Effect of Metals — Copper
			Iron
—	—		Reactions in Substance
—	—		H_2SO_4 conc.
—	—		Dilute HCl
			Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: 60 g/l at 25°C Effect threads: acrylic, polyester and triacetate slightly stained, acetate stained, cotton and nylon heavily stained, viscose very heavily stained	Solubility in water: good		**NOTES**

C.I. Reactive Brown 1—3

C.I. Reactive Brown	1	2	3
CHEMICAL CLASS	Disazo	Azo	Monoazo
REACTIVE SYSTEM	Monochlorotriazinyl	Monochlorotriazinyl	—
C.I. CONSTITUTION NO.	26440	—	—
HUE			
Daylight	Brown	Orange Brown	Reddish Brown
Artificial light (tungsten)	Redder	Slightly redder	—
DYEING			
Cellulose	4 (a, b), 5 (a, b), 6 (a, b, c)	4 (a, b), 5 (a, b), 6 (a, b, c)	Pad-steam or pad-bake
Nylon	—	—	—
Silk	—	—	—
Wool	—	Acid (for ingrain effects). Acetic acid + cationic agent for level dyeing	
PRINTING	Cellulose, nylon, silk and wool: as for C.I. Reactive Yellow 2	Cellulose, silk and wool: as for C.I. Reactive Yellow 2 Vigoureux printing	Cellulose: alkaline paste (alginate or emulsion thickening); fixed by neutral steam or baking
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	1 (yellower)	3–4	—
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	5–6	6	6
normal	6	6–7	6–7
2× normal	6	6–7	6–7
Peroxide Bleach — Alteration	5 (bath 1)	4	3–4
Staining	—	5	4
Perspiration — Alteration	—	—	—
Staining	—	—	—
Soda Boil — Alteration	—	—	—
Staining	—	—	—
Washing — Alteration	—	5	5 (Test 4)
Staining	—	5	5
OTHER PROPERTIES			
Dischargeability	Good*	Good (neutral and alkaline)	Poor (alkaline)
Effect of Metals — Copper	4 (duller)	Slightly duller	—
Iron	4–5	—	—
Reactions in Substance			
H_2SO_4 conc.	Green; on diln—yellow	Navy blue; on diln—orange brown	Orange; on diln—no change
Dilute HCl	Yellower	Orange brown	—
Dilute NaOH	Brown	Reddish brown	—
NON-TEXTILE USAGE			
NOTES	Solubility in water: very good; not sensitive to hard water Suitable for crease-resist finishes (4, yellower) *Discharges to moderate white	Solubility in water: very good; not sensitive to hard water Suitable for crease-resist finishes	Suitable for crease-resist finishes

C.I. Reactive Brown	4	5	6
CHEMICAL CLASS	Monoazo	Azo	Azo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Reddish Brown	Yellowish Brown	Reddish Brown
Artificial light (tungsten)	Redder	Redder	Redder
DYEING			
Cellulose	Pad-steam or pad-bake	Continuous, pad (alkali)-batch and batchwise processes	Pad-fix (dry heat) process
Nylon	—	Stained	Heavily stained
Silk	—	Salt + Na_3PO_4 at 50→85°C	—
Wool	—	Acetic acid + cationic agent at 50°→100°C	—
PRINTING	Cellulose: alkaline paste (alginate or emulsion thickening); fixed by neutral steam or baking	Cellulose, silk and wool: as for C.I. Reactive Yellow 8	Cellulose: suitable; fixation by steam or dry heat Print pastes have good stability
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	—	3–4	4–5
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	5	6–7	5–6
normal	5–6	7	6–7
2× normal	6–7	—	—
Peroxide Bleach — Alteration	3–4	—	—
Staining	4–5	—	—
Perspiration — Alteration	4–5 (acid)	4–5 (acid or alkaline)	5 (acid or alkaline)*
Staining	5	5	4
Soda Boil — Alteration	3–4	—	—
Staining	3–4	—	—
Washing — Alteration	5 (Test 4)	5 (95°C)	4–5 (95°C)
Staining	3–4	5	4–5
OTHER PROPERTIES			
Dischargeability	Poor (alkaline)	2	2
Effect of Metals — Copper	—	—	—
Iron	—	—	—
Reactions in Substance			
H_2SO_4 conc.	Orange; on diln—yellowish orange	—	—
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE			
NOTES	Crease-resist finishes: hue unchanged, light fastness improved Suitable for PVC coating	Solubility in water: 100 g/l Suitable for crease-resist finishes; redder hue and lower light fastness	Solubility in water: 200 g/l Staining: acetate, polyester and triacetate unstained; acrylic stained Crease-resist finishes: hue becomes much redder *AATCC test

7	8	9	C.I. Reactive Brown
Disazo	Monoazo (1:2 chromium complex)	Monoazo (chromium complex)	**CHEMICAL CLASS**
—	—	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Reddish Brown	Reddish Grey	Bordeaux	**HUE** Daylight
Yellower	Yellower	Redder	Artificial light (tungsten)
Batchwise, exhaustion or pad-fixation process	Pad-dry-steam, jig, pad-jig, pad-batch processes*	4 (a, b), 5 (a, b), 6 (a, b, c)	**DYEING** Cellulose
—	—	Low substantivity	Nylon
—	—	—	Silk
—	—	—	Wool
		Cellulose: as for C.I. Reactive Yellow 2. Extra urea is needed for heavy prints on viscose. Fixation by steaming or baking on cotton (steaming only on viscose) *	**PRINTING**
Cotton ISO	Cotton ISO	Cotton ISO	**FASTNESS PROPERTIES** Fibre Method
3 (duller)	4–5 (redder)	3–4	Alkali
4 (yellower)	3 (redder)†	4–5	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
5–6	—	—†	Light — $\frac{1}{3}$—$\frac{1}{2}$ normal
6	5–6 (weaker, redder)	4–5	normal
6	5–6 (weaker, redder)	4–5	2× normal
5	4–5 (redder)	5	Peroxide Bleach — Alteration
5	5	4–5	Staining
4–5 (redder)	5	4–5	Perspiration — Alteration
5	4	3–4	Staining
3 (redder)	3	3–4	Soda Boil — Alteration
3	4	3	Staining
4–5	4–5	4–5 (100°C)	Washing — Alteration
5	5	4–5	Staining
Poor	Moderate	Moderate–poor	**OTHER PROPERTIES** Dischargeability
4–5	4–5 (redder)	5	Effect of Metals — Copper
4–5 (duller)	4–5 (yellower)	5	Iron
Navy blue; on diln—navy blue	—	—	Reactions in Substance
No change	—	—	H_2SO_4 conc.
Bluish violet	—	—	Dilute HCl
			Dilute NaOH
			NON-TEXTILE USAGE
Solubility: 120 g/l in 30 g/l salt solution at 50°C Crease-resist finishes: hue becomes weaker and yellower; light fastness reduced	Solubility: 140 g/l in 30 g/l salt solution at 50°C Suitable for crease-resist finishes (hue weaker, light fastness lower). *Low affinity †Aftertreated 4 (weaker, redder)	Solubility in water: 90 g/l at 50°C (30 g/l with 30 g/l salt) Suitable for crease-resist finishes *Suitable for naphthol grounds and printing on silk and wool †Light fastness on cotton at $\frac{1}{25}$ normal depth 3–4	**NOTES**

C.I. Reactive Brown	10	11
CHEMICAL CLASS	Monoazo (chromium complex)	Azo
REACTIVE SYSTEM	—	—
C.I. CONSTITUTION NO.	—	—
HUE		
Daylight	Bordeaux	Reddish Brown
Artificial light (tungsten)	Redder	Yellower
DYEING		
Cellulose	Batchwise and pad(alkali)-batch (cold) processes	Pad-fix, pad-roll, pad-jig and exhaustion processes
Nylon	—	—
Silk	—	—
Wool	—	—
PRINTING		On cellulose, silk and wool: fixation by steam or baking
FASTNESS PROPERTIES		
Fibre	Cotton	Cotton
Method	ISO	ISO
Alkali	4	3–4 (bluer)
Burnt Gas Fumes	4 (yellower)*	—
Carbonising — Alkaline rinse	—	—
Neutral rinse	—	—
Decatising	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—†	5
normal	4–5	5–6
2× normal	5	6
Peroxide Bleach — Alteration	—	5
Staining	—	—
Perspiration — Alteration	5	—
Staining	4	—
Soda Boil — Alteration	4–5	—
Staining	3	—
Washing — Alteration	4–5 (ISO5)	4–5
Staining	5	5
OTHER PROPERTIES		
Dischargeability	Coloured discharges at low depths	Poor
Effect of Metals — Copper	5	4
Iron	5	5
Reactions in Substance		
H_2SO_4 conc.	—	Bluish violet; on dilution—brownish red
Dilute HCl	—	Brownish orange
Dilute NaOH	—	Reddish brown
NON-TEXTILE USAGE		
NOTES	Solubility in water: 120 g/l (60 g/l with 30 g/l salt) Suitable for crease-resist finishes; some change in hue and loss of light fastness *Burnt gas fumes 4–5 when aftertreated with melamine-formaldehyde †Light fastness on cotton at $\frac{1}{25}$ normal depth: 3	Solubility in water: very good Not sensitive to hard water Suitable for crease-resist finishes

12	13	14	C.I. Reactive Brown
Azo (metal complex)		Azo (metal complex)	CHEMICAL CLASS
—		Monochlorotriazinyl	REACTIVE SYSTEM
—		—	C.I. CONSTITUTION NO.
Brown	This C.I. Generic Name is discontinued. The dyes formerly listed under it now appear under C.I. Reactive Brown 4	Brown	HUE Daylight
Little yellower, brighter		Redder	Artificial light (tungsten)
—			DYEING Cellulose
—			Nylon
—			Silk
Weak acid; ammonium acetate (or sulphate)+acetic acid. Fixation on boiling			Wool
		Cellulose: fixation by steaming, thermofix or two-phase process	PRINTING
Wool ISO		Cellulose ISO	FASTNESS PROPERTIES Fibre Method
— —		4 (yellower) —	Alkali Burnt Gas Fumes
5		—	Carbonising — Alkaline rinse
4–5 (redder)		—	Neutral rinse
5 (severe)		—	Decatising
6		4–5	Light — $\frac{1}{3}$—$\frac{1}{2}$ normal
6–7		5	normal
7		5–6	2× normal
5		—	Peroxide Bleach — Alteration
4–5		—	Staining
5		—	Perspiration — Alteration
5		—	Staining
—		—	Soda Boil — Alteration
—		—	Staining
4–5 (yellower) (ISO3)		4–5	Washing — Alteration
4–5		5	Staining
—		Not dischargeable	OTHER PROPERTIES Dischargeability
4–5 (yellower)		—	Effect of Metals — Copper
4–5 (yellower)		—	Iron
—		Green; on diln—brownish orange	Reactions in Substance H_2SO_4 conc.
—		Dark reddish brown	Dilute HCl
—		Brownish red	Dilute NaOH
Clothing leathers			NON-TEXTILE USAGE
Solubility in water: 100 g/l at 90°C		Solubility in water: very good Suitable for crease-resist finishes	NOTES

C.I. Reactive Brown	15	16
CHEMICAL CLASS	Azo (metallised)	Monoazo
REACTIVE SYSTEM	—	—
C.I. CONSTITUTION NO.	—	—
HUE		
Daylight	Dull Red-brown	Yellowish Brown
Artificial light (tungsten)	—	Dull orange
DYEING		
Cellulose	Alkaline pad liquor containing urea;* one-bath pad-steam or heat fixation	Batchwise, exhaustion or pad-fixation processes
Nylon	—	—
Silk	—	—
Wool	—	—
PRINTING	Cellulose: alkaline paste containing urea and special assistant, thickened with alginate; dried and fixed with neutral steam	Cellulose: direct and discharge styles
FASTNESS PROPERTIES		
Fibre	Cotton	Cotton
Method	ISO	ISO
Alkali	—	4–5 (bluer)
Burnt Gas Fumes	—	—
Carbonising — Alkaline rinse	—	—
Neutral rinse	—	—
Decatising	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	4–5	6
normal	5	6–7
2× normal	—	7
Peroxide Bleach — Alteration	4	—
Staining	5	—
Perspiration — Alteration	4, 4–5 (acid, alkaline)	3–4 (yellower)
Staining	4–5, 4	4–5
Soda Boil — Alteration	—	—
Staining	—	—
Washing — Alteration	4–5	4 (95°C)
Staining	4–5	5
OTHER PROPERTIES		
Dischargeability	—	Fairly good
Effect of Metals — Copper	—	—
Iron	—	—
Reactions in Substance		
H_2SO_4 conc.	Red brown; on dilution—red brown	—
Dilute HCl	—	—
Dilute NaOH	Weaker, bluer	—
NON-TEXTILE USAGE		
NOTES	Solubility in water: 100 g/l Suitable for crease-resist finishes *With special assistant This dye does not react directly with the fibre but requires the use of a fixing agent	Solubility in water: 60 g/l at 20°, 100 g/l at 100°C Suitable for crease-resist finishes and PVC coating

17	18	C.I. Reactive Brown
Azo (chromium complex)	Disazo (metal complex)	**CHEMICAL CLASS**
—	—	**REACTIVE SYSTEM**
—	—	**C.I. CONSTITUTION NO.**
Reddish Brown	Reddish Brown	**HUE**
Yellower	—	Daylight
		Artificial light (tungsten)
		DYEING
		Cellulose
		Nylon
		Silk
		Wool
Cellulose: steaming, dry heat, high-temperature steaming, flash-age (two-phase) and wet development processes Printing on C.I. Azoic Coupling Component 5*		**PRINTING**
Cotton	Cotton	**FASTNESS PROPERTIES**
ISO	ISO	Fibre
		Method
4–5	1	Alkali
5	—	Burnt Gas Fumes
—	—	Carbonising — Alkaline rinse
—	—	Neutral rinse
—	—	Decatising
—	5–6	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
4	5–6	normal
4	6	2× normal
4	—	Peroxide Bleach — Alteration
3	—	Staining
4–5	4 (acid)	Perspiration — Alteration
3	3	Staining
4	—	Soda Boil — Alteration
3	—	Staining
4–5 (Test 3)	4–5 (95°C)	Washing — Alteration
4–5	4–5	Staining
Poor at 1/1, fair at $\frac{1}{25}$ (neutral or alkaline)	Dischargeable to white (medium dyeings)	**OTHER PROPERTIES**
4–5	—	Dischargeability
4–5	—	Effect of Metals — Copper
		Iron
—	—	Reactions in Substance
—	—	H_2SO_4 conc.
—	—	Dilute HCl
		Dilute NaOH
		NON-TEXTILE USAGE
Solubility in water: 200 g/l at 20°C (140 g/l with 30 g/l salt) Medium substantivity The use of metal sequestering agents based on ethylenediaminetetraacetic acid should be avoided *Also for printing silk, chlorinated wool and polyester–cotton unions	Suitable for PVC coating	**NOTES**

C.I. Reactive Brown	19		20
CHEMICAL CLASS	Disazo		Azo
REACTIVE SYSTEM	—		—
C.I. CONSTITUTION NO.	—		—
HUE			
Daylight	Reddish Brown		Brown
Artificial light (tungsten)	—		—
DYEING			
Cellulose	Cold pad-batch		4 (a, b), 5 (a, b), 6 (a, b, c)
Nylon	—		Suitable
Silk	—		
Wool	—		
PRINTING	Cellulose: printed with urea+NaOH and fixed by neutral steam or dry heat Paste is stable for 14 days at 20°C Unsuitable for overprinting with caustic alkali		Cellulose, nylon, silk and wool: as for C.I. Reactive Yellow 2
FASTNESS PROPERTIES			
Fibre	Cotton	Viscose	Cellulose
Method	ISO	ISO	ISO
Alkali	—	—	—
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	5	4–5	—
normal	5	4–5	4
2× normal	—	—	—
Peroxide Bleach — Alteration	4–5 (wash)	5 (wash)	—
Staining	3–4	5	—
Perspiration — Alteration	4–5 (acid or alk)	4–5, 5 (acid, alk)	4–5
Staining	4	3–4	—
Soda Boil — Alteration	4–5	4	—
Staining	1–2	1–2	—
Washing — Alteration	4	5	3–4 (5×95°C)
Staining	5	4–5	—
OTHER PROPERTIES			
Dischargeability	Dischargeable to white at low depths		Poor
Effect of Metals — Copper	—		—
Iron	—		—
Reactions in Substance			
H_2SO_4 conc.	—		—
Dilute HCl	—		—
Dilute NaOH	—		—
NON-TEXTILE USAGE			
NOTES	Suitable for PVC coating Crease-resist finishes: hue unchanged, light fastness reduced		Solubility in water: good

21	22	C.I. Reactive Brown
Monoazo	Azo	**CHEMICAL CLASS**
—	—	**REACTIVE SYSTEM**
—	—	**C.I. CONSTITUTION NO.**
Reddish Brown	Yellowish Brown	**HUE** Daylight
—	—	Artificial light (tungsten)
Padded cold with urea + $NaHCO_3$; fixation by steam or dry heat	Padded cold with urea + $NaHCO_3$; fixation by steam or dry heat	**DYEING** Cellulose
—	—	Nylon
—	—	Silk
—	—	Wool
Cellulose: direct processes, print paste containing $NaHCO_3$ and a neutral alginate thickener; fixation by neutral steaming	Cellulose: direct processes, print paste containing $NaHCO_3$ and a neutral alginate thickener; fixation by neutral steaming	**PRINTING**
Cotton ISO	Cotton ISO	**FASTNESS PROPERTIES** Fibre Method
3–4	4–5	Alkali
—	—	Burnt Gas Fumes
—	—	Carbonising — Alkaline rinse
—	—	Neutral rinse
—	—	Decatising
—	—	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
5	4	normal
—	—	2× normal
—	—	Peroxide Bleach — Alteration
—	—	Staining
5	4	Perspiration — Alteration
5	5	Staining
—	—	Soda Boil — Alteration
—	—	Staining
5 (70°C)	5	Washing — Alteration
5	5	Staining
Dischargeable to white	Dischargeable to white	**OTHER PROPERTIES** Dischargeability
—	—	Effect of Metals — Copper
—	—	Iron
—	—	Reactions in Substance
—	—	H_2SO_4 conc.
—	—	Dilute HCl
		Dilute NaOH
		NON-TEXTILE USAGE
Solubility in water: good	Solubility in water: good	**NOTES**

C.I. Reactive Black 1—3

C.I. Reactive Black	1	2	3
CHEMICAL CLASS	Monoazo	Violanthrone	Monoazo
REACTIVE SYSTEM	Monochlorotriazinyl	—	Monochlorotriazinyl
C.I. CONSTITUTION NO.	17916	—	—
HUE			
Daylight	Black	Grey	Black
Artificial light (tungsten)	Redder	—	Black
DYEING			
Cellulose	4 (a, b), 5 (a, b), 6 (a, b, c)		4 (a, b), 5 (a, b), 6 (a, b, c); 5 (a) preferred
Nylon	Suitable		—
Silk	—		—
Wool	—		—
PRINTING	Cellulose, silk and wool: as for C.I. Reactive Yellow 2	Cellulose: alkaline paste (alginate or emulsion thickening); fixed by neutral steam or baking	Cellulose: as for C.I. Reactive Yellow 2
FASTNESS PROPERTIES			
Fibre	Cotton*	Cotton	Cotton
Method	ISO	ISO	ISO
			As black / As grey
Alkali	4 (greener)	—	5 / 4
Burnt Gas Fumes	—	—	— / —
Carbonising — Alkaline rinse	—	—	— / —
Neutral rinse	—	—	— / —
Decatising	—	—	— / —
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	6	— / 5–6
normal	6	6	— / 6
2× normal	—	—	7–8 / 6–7
Peroxide Bleach — Alteration	4–5	5	4–5 / 3–4
Staining	4–5	4–5	— / —
Perspiration — Alteration	3–4 (weaker, greener)	—	— / —
Staining	4–5	—	— / —
Soda Boil — Alteration	—	—	— / —
Staining	—	—	— / —
Washing — Alteration	5 (5×100°C)	4–5	5 / 4
Staining	4–5	4–5	— / —
OTHER PROPERTIES			
Dischargeability	Not dischargeable as black; good as grey	Not dischargeable	Not dischargeable
Effect of Metals — Copper	3 (as grey)	—	Unaffected
Iron	3–4 (as grey)	—	Unaffected
Reactions in Substance			
H_2SO_4 conc.	Blue; on diln—violet	Dull violet black; on diln—black	Greener; on diln—violet
Dilute HCl	Unchanged	—	Slightly redder
Dilute NaOH	Unchanged	—	Slightly greener
NON-TEXTILE USAGE			
NOTES	Solubility in water: very good; not sensitive to hard water Suitable for printing on C.I. Azoic Coupling Components 2 and 5 Suitable for crease-resist finishes (4–5) *Fastness on nylon (ISO): light 7	Suitable for crease-resist finishes	Solubility in water: very good; not sensitive to hard water Suitable for crease-resist finishes

C.I. Reactive Black 4—7

C.I. Reactive Black	4	5
CHEMICAL CLASS	Monoazo	Disazo
REACTIVE SYSTEM	Trichloropyrimidinyl	Vinylsulphonyl
C.I. CONSTITUTION NO.	—	—
HUE		
Daylight	Black	Black
Artificial light (tungsten)	Trace redder	—
DYEING		
Cellulose	As for C.I. Reactive Yellow 8	Cold padding with urea and $NaHCO_3$, drying and fixing with steam or dry heat
Nylon	—	—
Silk	As for C.I. Reactive Yellow 8	—
Wool	As for C.I. Reactive Yellow 8	—
PRINTING	Cellulose, silk and wool: as for C.I. Reactive Yellow 8	Cellulose: direct printing with $NaHCO_3$ and a neutral alginate thickener and fixing with neutral steam
FASTNESS PROPERTIES		
Fibre	Cotton	Cotton
Method	ISO	ISO
Alkali	4	3
Burnt Gas Fumes	—	—
Carbonising — Alkaline rinse	—	—
Neutral rinse	—	—
Decatising	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	5–6	2–3
normal	7–8 (black)	5
2× normal	—	—
Peroxide Bleach — Alteration	4 (wash)	—
Staining	5	—
Perspiration — Alteration	5	4–5 (greener)
Staining	5	5
Soda Boil — Alteration	—	—
Staining	—	—
Washing — Alteration	4–5 (95°C)	4–5 (75°C)
Staining	5	5
OTHER PROPERTIES		
Dischargeability	2	Not suitable for discharge
Effect of Metals — Copper	—	—
Iron	—	—
Reactions in Substance		
H_2SO_4 conc.	—	—
Dilute HCl	—	—
Dilute NaOH	—	—
NON-TEXTILE USAGE		
NOTES	Solubility in water: very good Crease-resist finishes: unaffected	Solubility in water: good

6	7	C.I. Reactive Black
Azo	Disazo	**CHEMICAL CLASS**
Trichloropyrimidinyl	—	**REACTIVE SYSTEM**
—	—	**C.I. CONSTITUTION NO.**
Bluish Grey	Black	**HUE** Daylight
Trace weaker	—	Artificial light (tungsten)
Continuous, pad (alkali)-batch and batch-wise processes Salt + Na_3PO_4 at 50°→85°C Acetic acid + cationic agent at 50°→100°C		**DYEING** Cellulose Nylon Silk Wool
Cellulose, silk and wool: as for C.I. Reactive Yellow 8	Cellulose: alkaline paste (alginate or emulsion thickening); fixation by neutral steam or dry heat. Paste is stable for 7–9 days at 20°C for black or > 28 days for grey*	**PRINTING**
Cotton ISO — — — — — 5 5–6 — 4 (wash) 5 5 5 — — 4–5 (95°C) 5	Cotton ISO Black / Grey — / — — / — — / — — / — — / — — / — 6–7 / 5 — / — 4–5 / 3 (redder) 5 / 4–5 5 / 5 5 / 5 4–5 / 4–5 4–5 / 4–5 5 / 4–5 5 / 5	**FASTNESS PROPERTIES** Fibre Method Alkali Burnt Gas Fumes Carbonising — Alkaline rinse Neutral rinse Decatising Light — $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Peroxide Bleach — Alteration Staining Perspiration — Alteration Staining Soda Boil — Alteration Staining Washing — Alteration Staining
	As black, poor; as grey, very good — — Dull bordeaux; on dilution—grey — —	**OTHER PROPERTIES** Dischargeability Effect of Metals — Copper Iron Reactions in Substance H_2SO_4 conc. Dilute HCl Dilute NaOH
		NON-TEXTILE USAGE
Solubility in water: very good Crease-resist finishes: weaker, light fastness slightly reduced	Suitable for PVC coating Crease-resist finishes: hue unchanged, light fastness improved *Suitable for overprinting with caustic alkali	**NOTES**

C.I. Reactive Black 8—12

C.I. Reactive Black	8	9	10
CHEMICAL CLASS	Monoazo (metal complex)	Disazo (copper complex)	Disazo
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Bluish Grey	Bluish Grey	Black
Artificial light (tungsten)	Little redder, duller	—	—
DYEING			
Cellulose	Batchwise (jig or pad-jig), pad (NaOH)-batch (cold) or continuous processes		Cold pad-batch (black only)
Nylon	—		—
Silk	—		—
Wool	—		—
PRINTING	Cellulose: steaming, dry heat, high-temperature steaming, flash-age (2-phase) and wet development processes Printing on C.I. Azoic Coupling Components 2 and 5*		Cellulose: steam, bake, alkali shock (black only)
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton*	Cotton
Method	ISO		ISO
Alkali	4 (greener)	4 (yellower)	4–5
Burnt Gas Fumes	4 (redder)	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	—	—
normal	6 (grey)	5–6	5
2× normal	—	—	—
Peroxide Bleach — Alteration	3 (weaker and greener)	—	5
Staining	5	—	—
Perspiration — Alteration	4–5 (greener)	5	—
Staining	3	4–5	—
Soda Boil — Alteration	4–5 (greener) (open kier)	—	—
Staining	4–5	—	—
Washing — Alteration	5 (ISO3)	4–5 (95°C)	4–5
Staining	5	4–5	4–5
OTHER PROPERTIES			
Dischargeability	At $\frac{1}{25}$ depth good; at normal depth poor	Poor (on wool)	Not dischargeable
Effect of Metals — Copper	3–4 (redder)	—	—
Iron	4	—	—
Reactions in Substance			
H_2SO_4 conc.	—	—	Dark greenish blue*
Dilute HCl	—	—	—
Dilute NaOH	—	—	—
NON-TEXTILE USAGE			
NOTES	Solubility in water: 30 g/l at 20°C, 80 g/l at 50°C (70 g/l with 30 g/l salt) Mainly for grey hues on cotton Sequestering agents should not be added to dye liquors Crease-resist finishes: change in hue and slight loss of light fastness Not suitable for vulcanising *Also for printing silk, chlorinated wool and polyester-cotton unions	Solubility in water: 40 g/l Suitable for crease-resist finishes (lower light fastness) *Fastness on nylon: light 5; on silk: light 4, washing (60°C) 4–5, 5; on wool: light 4	Solubility in water: very good; not sensitive to hard water Suitable for crease-resist finishes *On dilution—blue

11	12	C.I. Reactive Black
Azo (metal complex)	Azo (metal complex)	**CHEMICAL CLASS**
—	—	**REACTIVE SYSTEM**
—	—	**C.I. CONSTITUTION NO.**
Black	Black	**HUE** Daylight
No change	Duller	Artificial light (tungsten)
—	—	**DYEING** Cellulose
—	—	Nylon
—	—	Silk
Weak acid (pH 6–6·5), ammonium acetate or sulphate + acetic acid; fixed by boiling	Weak acid (pH 6–6·5), ammonium acetate or sulphate + acetic acid; fixed by boiling	Wool
		PRINTING
Wool ISO	Wool ISO	**FASTNESS PROPERTIES** Fibre Method
— — 5 5 5 (severe)	— — 5 4–5 (redder) 5 (severe)	Alkali Burnt Gas Fumes Carbonising — Alkaline rinse Neutral rinse Decatising
5–6 7 7	— 6 6–7	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal
5 2 5 4–5	4–5 (redder) 5 5 5	Peroxide Bleach — Alteration Staining Perspiration — Alteration Staining
— — 5 (ISO3) 3–4	— — 4–5 (ISO3) 5	Soda Boil — Alteration Staining Washing — Alteration Staining
— 5 5	— 3 (greener, duller) 4 (duller)	**OTHER PROPERTIES** Dischargeability Effect of Metals — Copper Iron
— — —	— — —	Reactions in Substance H_2SO_4 conc. Dilute HCl Dilute NaOH
Clothing leathers	Clothing leathers	**NON-TEXTILE USAGE**
Solubility in water: 30 g/l at 90°C Staining: acetate 4, cotton 2, nylon 1, polyester 3–4, silk 1, viscose 3	Solubility in water: 100 g/l at 90°C Effect threads: acetate 4–5, cotton 3, nylon 1, polyester 4, silk 2, viscose 3	**NOTES**

C.I. Reactive Black 13—17

C.I. Reactive Black	13	14	15
CHEMICAL CLASS	Azo (1:2 metal complex)	Monoazo	Azo (metallised)
REACTIVE SYSTEM	Monochlorotriazinyl	—	Dichloropyridazonyl
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Greenish Grey	Neutral Grey→Black	Bluish Grey
Artificial light (tungsten)	Redder	Redder	—
DYEING			
Cellulose	Batchwise, exhaustion or pad-fixation processes	Pad-fix and exhaustion processes	Pad-steam or pad-thermofix
Nylon	—	—	—
Silk	—	—	—
Wool	—	—	—
PRINTING		Cellulose: suitable	
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	5	4	—
Burnt Gas Fumes	—	—	—
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	4–5	5	4–5
normal	5	5–6	6
2× normal	5–6	—	—
Peroxide Bleach — Alteration	—	—	—
Staining	—	—	—
Perspiration — Alteration	4–5	4–5	4–5 (acid or alkaline)
Staining	5	5	5
Soda Boil — Alteration	3 (yellower)	—	—
Staining	3–4	—	—
Washing — Alteration	4–5	4–5 (95°C)	4–5 (Test 4)
Staining	4–5	5	5
OTHER PROPERTIES			
Dischargeability	—	Moderate	Good
Effect of Metals — Copper	4	—	—
Iron	3–4	—	—
Reactions in Substance			
H_2SO_4 conc.	Blue; on dilution—rubine	—	Dirty bluish violet; on diln—violet
Dilute HCl	Greyish blue	—	—
Dilute NaOH	Greyish blue	—	(4%) Decolorised
NON-TEXTILE USAGE			
NOTES	Solubility in water: 100 g/l Staining: acetate, acrylic, nylon and triacetate unstained Suitable for crease-resist finishes (redder)	Solubility in water: 200 g/l at 100°C Staining: acrylic and triacetate slightly stained; acetate and nylon heavily stained Suitable for crease-resist finishes (slight change in hue)	Solubility in water: 60 g/l at 20°, 120 g/l at 90°C Suitable for crease-resist finishes

16	17	C.I. Reactive Black
Azo	Azo	**CHEMICAL CLASS**
Acryloylamido	—	**REACTIVE SYSTEM**
—	—	**C.I. CONSTITUTION NO.**
Black	Black or neutral grey	**HUE**
—	—	Daylight
		Artificial light (tungsten)
Padded with alkali; fixed by steaming, thermofix, batching or pad-roll process	Cold pad-batch process	**DYEING**
—	—	Cellulose
—	—	Nylon
—	—	Silk
		Wool
	Cellulose: printed with urea+alkali and fixed by neutral steam or dry heat Paste is stable for more than 28 days at 20°C. Suitable for overprinting with caustic alkali	**PRINTING**
Cotton ISO	Cotton ISO	Viscose ISO	**FASTNESS PROPERTIES** Fibre Method
—	—	—	Alkali
—	—	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
—	—	—	Light — $\frac{1}{3}$—$\frac{1}{2}$ normal
5	7	7	normal
—	—	—	2× normal
—	4	4–5	Peroxide Bleach — Alteration
—	4	3–4	Staining
4–5 (acid or alkaline)	5 (acid and alk)	4–5 (acid and alk)	Perspiration — Alteration
3	3	2–3	Staining
—	4–5	3–4	Soda Boil — Alteration
—	2	2	Staining
4–5 (Test 4)	4–5	3	Washing — Alteration
4–5	5	3–4	Staining
Poor	Not dischargeable to white	**OTHER PROPERTIES** Dischargeability
—	—	Effect of Metals — Copper
	—	Iron
Dirty bluish grey; on dilution—blue	—	Reactions in Substance H_2SO_4 conc.
—	—	Dilute HCl
(4%) Blue-violet	—	Dilute NaOH
		NON-TEXTILE USAGE
Solubility in water: 50 g/l at 20°C, 150 g/l at 90°C Suitable for crease-resist finishes	Suitable for PVC coating Crease-resist finishes: hue unchanged, light fastness may be slightly reduced	**NOTES**

C.I. Reactive Black	18	19	20
CHEMICAL CLASS	Monoazo (chromium complex)	Azo (1:2 chromium complex)	Azo (metallised)
REACTIVE SYSTEM	—	—	—
C.I. CONSTITUTION NO.	—	—	—
HUE			
Daylight	Bluish Grey	Black	Black
Artificial light (tungsten)	Duller	—	Unchanged
DYEING			
Cellulose	Pad-fix or exhaustion process		—
Nylon	—		Unsuitable
Silk	—		—
Wool	—		—
PRINTING		Cellulose: one-bath pad-steam and thermofixation processes*	Cellulose: steaming, dry heat, high-temperature steaming, flash-age (2-phase) and wet development processes. Paste is stable for more than 28 days*
FASTNESS PROPERTIES			
Fibre	Cotton	Cotton	Cotton
Method	ISO	ISO	ISO
Alkali	3–4 (redder, duller)	—	4 (greener)
Burnt Gas Fumes	4–5	—	5
Carbonising — Alkaline rinse	—	—	—
Neutral rinse	—	—	—
Decatising	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	5–6	—
normal	5	6	7
2× normal	5–6	—	—
Peroxide Bleach — Alteration	3–4 (redder)	4 (wash)	—
Staining	4–5	5	—
Perspiration — Alteration	4–5 (acid)	4–5 (acid and alk)	5
Staining	3–4	4–5	3–4
Soda Boil — Alteration	3 (redder)	—	—
Staining	3	—	—
Washing — Alteration	4 (ISO5)	4 (ISO4)	5 (ISO4)
Staining	5	4–5	5
OTHER PROPERTIES			
Dischargeability	Moderate–good		Poor (neutral and alkaline)
Effect of Metals — Copper	4		—
Iron	4–5		—
Reactions in Substance			
H_2SO_4 conc.	—		—
Dilute HCl	—		—
Dilute NaOH	—		—
NON-TEXTILE USAGE			
NOTES	Solubility in water: 140 g/l at 20°C, 170 g/l at 50°C Staining: acetate 4–5, acrylic 4–5, nylon 4, polyester 5, triacetate 5, wool 2 (dye fixed at 50°C). Medium substantivity and reactivity. Suitable for crease-resist finishes and for goods to be vulcanised	*This dye does not react directly with the fibre, but requires the use of a fixing agent	*Suitable for printing on C.I. Azoic Coupling Components 2 and 5. May be printed on silk, chlorinated wool or polyester–cotton unions

21	22	23	C.I. Reactive Black
Azo	Disazo (copper complex)	Monoazo	**CHEMICAL CLASS**
—	Monochlorotriazinyl	—	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Black	Bluish grey	Bluish Grey	**HUE** Daylight
—	Redder, duller	Slightly redder	Artificial light (tungsten)
Pad-cure and one-bath pad-steam methods	Batchwise, pad-batch, pad-thermo-fix and pad(alkali)-steam processes	Suitable, but no special advantage	**DYEING** Cellulose
—	—	—	Nylon
—	—	—	Silk
—	—	—	Wool
Neutral steam. Paste stable for >28 days at 20°C. Suitable for over-printing with caustic alkali		Cellulose: short steaming, thermo-fixation, high-temperature stenter fixation, high-temperature steam, caustic shock, mini-flash or pad-steam and cold pad-batch methods	**PRINTING**
Cotton ISO	Cotton ISO	Cellulose ISO	**FASTNESS PROPERTIES** Fibre Method
4–5	4 (greener)	4–5	Alkali
—	4 (redder)	—	Burnt Gas Fumes
—	—	—	Carbonising — Alkaline rinse
—	—	—	Neutral rinse
—	—	—	Decatising
4	—	4–5	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
—	5	5	normal
—	5	—	2× normal
4–5	2 (weaker, greener)	4–5	Peroxide Bleach — Alteration
5	4	5	Staining
4 (alkaline)	4	—	Perspiration — Alteration
4–5	3–4	—	Staining
4	2	—	Soda Boil — Alteration
5	5	—	Staining
5 (at boil)	4–5 (ISO4)	4–5	Washing — Alteration
5	3	5	Staining
See note*	Not suitable for discharge	—	**OTHER PROPERTIES** Dischargeability
—	4–5	—	Effect of Metals — Copper
—	4–5	—	Iron
—	—	Blue; on dilution—reddish violet	Reactions in Substance H_2SO_4 conc.
—	—	Greyish blue	Dilute HCl
—	—	Reddish blue	Dilute NaOH
			NON-TEXTILE USAGE
Solubility in water: >100 g/l *Dischargeable to white up to 10 g/l dye in pad liquor (neutral) or 20 g/l (alkaline)	Solubility in water: 70 g/l at 20°, 140 g/l at 50°C (with 30 g/l salt: 30 g/l at 20°, 80 g/l at 50°C)	Solubility in water: very good; not sensitive to hard water Suitable for crease-resist finishes	**NOTES**

C.I. Reactive Black	24	25
CHEMICAL CLASS	Monoazo (1:2 chromium complex)	Monoazo (1:2 metal complex)
REACTIVE SYSTEM	—	Dichlorophthalazinecarbonyl
C.I. CONSTITUTION NO.	—	—
HUE		
Daylight	Black	Greenish Grey
Artificial light (tungsten)	Redder	Unchanged
DYEING		
Cellulose	Pad-(alkali shock), 2-bath pad-steam, pad-dry, pad-(wet fixation), pad-batch processes	Pad-thermofix, pad-batch, pad-steam, pad-roll and pad-jig methods
Nylon	—	—
Silk	—	—
Wool	—	—
PRINTING	Cellulose: 2-stage processes, including fixation by air exposure without steaming	Cellulose: printed with urea and $NaHCO_3$ or Na_2CO_3 and thermofixed; flash-age, alkali shock (cold or hot) methods Paste is stable for more than 4 weeks
FASTNESS PROPERTIES		
Fibre	Cotton	Cotton
Method	ISO	ISO
Alkali	4–5	5
Burnt Gas Fumes	3–4	5
Carbonising — Alkaline rinse	—	—
Neutral rinse	—	—
Decatising	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	6	5
normal	7	6
2× normal	—	—
Peroxide Bleach — Alteration	—	4
Staining	—	5
Perspiration — Alteration	4–5	5
Staining	4	5
Soda Boil — Alteration	—	—
Staining	—	—
Washing — Alteration	3–4 (95°C)	4–5 (ISO4)
Staining	4–5	5
OTHER PROPERTIES		
Dischargeability	Neutral 2, alkaline 2	2 (neutral or alkaline)
Effect of Metals — Copper	—	—
Iron	—	—
Reactions in Substance		
H_2SO_4 conc.	—	—
Dilute HCl	—	—
Dilute NaOH	—	—
NON-TEXTILE USAGE		
NOTES	Solubility in water: 125 g/l	Solubility in water: 100, 150, 200 g/l at 30, 60, 90°C, respectively

26	27	28	C.I. Reactive Black
Azo	Azo	Monoazo (metal complex)	**CHEMICAL CLASS**
—	—	Monochlorotriazinyl	**REACTIVE SYSTEM**
—	—	—	**C.I. CONSTITUTION NO.**
Greenish Black	Greenish Black	Bluish Grey	**HUE** Daylight
—	—	Much redder	Artificial light (tungsten)
Cold pad-batch, thermofix, steam and exhaustion processes	4 (a, b), 5 (a, b), 6 (a, b, c)	Exhaustion, pad-thermofix, pad-jig or pad-roll method	**DYEING** Cellulose
—	Suitable	—	Nylon
—		Weakly acid	Silk
—		Weakly acid	Wool
	Cellulose, nylon, silk and wool: as for C.I. Reactive Yellow 2	Cellulosic fibres	**PRINTING**

Cotton ISO	Cellulose ISO	Cellulose ISO	Silk ISO	**FASTNESS PROPERTIES** Fibre / Method
4 (redder)	—	4–5	—	Alkali
—	—	—	—	Burnt Gas Fumes
—	—	—	—	Carbonising — Alkaline rinse
—	—	—	—	Neutral rinse
—	—	—	—	Decatising
3–4	—	5	4–5	Light — $\frac{1}{3}$–$\frac{1}{2}$ normal
4–5	4–5	5–6	5	normal
5–6	—	—	—	2× normal
1	—	3	—	Peroxide Bleach — Alteration
4–5	—	4–5	—	Staining
3–4 (greener) (acid or alk)	4	4	4	Perspiration — Alteration
5	—	4–5	4 (silk)	Staining
2	—	—	—	Soda Boil — Alteration
2	—	—	—	Staining
5 (95°C)	3–4 (5 × 95°C)	4	4–5	Washing — Alteration
5	—	5	4 (silk)	Staining
	Poor	Neutral: good; alkaline: poor		**OTHER PROPERTIES** Dischargeability
	—	Unchanged		Effect of Metals — Copper
	—	Slightly redder		Iron
	—	—		Reactions in Substance H_2SO_4 conc.
	—	—		Dilute HCl
	—	—		Dilute NaOH
				NON-TEXTILE USAGE
Suitable for crease-resist finishes (usually giving a slight change in hue and sometimes a slight gain or loss in light fastness) Suitable for PVC coating	Solubility in water: good	Solubility in water: very good		**NOTES**

C.I. Reactive Black 29—32

C.I. Reactive Black	29	30	31	
CHEMICAL CLASS	Monoazo (metal complex)	Monoazo	Disazo	
REACTIVE SYSTEM	Monochlorotriazinyl	—	—	
C.I. CONSTITUTION NO.	—	—	—	
HUE				
Daylight	Black	Grey	Reddish Grey→Black	
Artificial light (tungsten)	Yellower	—	—	
DYEING				
Cellulose	Not suitable	Padded cold with urea + $NaHCO_3$; fixed by steam or dry heat	Exhaustion processes	
Nylon	—	—	—	
Silk	—	—	—	
Wool	—	—	—	
PRINTING	Cellulosic fibres	Cellulose: direct processes, print paste containing $NaHCO_3$ and a neutral alginate thickener; fixation by neutral steaming		
FASTNESS PROPERTIES				
Fibre	Cellulose	Cotton	Cotton	Viscose
Method	ISO	ISO	ISO	ISO
Alkali	4	4	3–4 (greener)	4 (greener)
Burnt Gas Fumes	—	—	—	—
Carbonising — Alkaline rinse	—	—	—	—
Neutral rinse	—	—	—	—
Decatising	—	—	—	—
Light — $\frac{1}{3}$–$\frac{1}{2}$ normal	—	—	—	—
normal	5–6	6	7	7
2× normal	—	—	—	—
Peroxide Bleach — Alteration	2–3	—	3 (bluer)	3 (bluer)
Staining	2	—	4	4–5
Perspiration — Alteration	4–5	4	3–4 (alk)	4 (greener)
Staining	4	5	5	5
Soda Boil — Alteration	—	—	—	—
Staining	—	—	—	—
Washing — Alteration	4–5	5 (70°C)	4 (95°C)	4–5 (95°C)
Staining	4–5	5	4	4–5
OTHER PROPERTIES				
Dischargeability	Poor	Dischargeable to white		
Effect of Metals — Copper	—	—		
Iron	—	—		
Reactions in Substance				
H_2SO_4 conc.	—	—		
Dilute HCl	—	—		
Dilute NaOH	—	—		
NON-TEXTILE USAGE				
NOTES	Solubility in water: very good	Solubility in water: good		

32		C.I. Reactive Black
		CHEMICAL CLASS **REACTIVE SYSTEM** **C.I. CONSTITUTION NO.**
		HUE Daylight Artificial light (tungsten)
This C.I. Generic Name is discontinued. The dyes formerly listed under it now appear under C.I. Reactive Black 26		**DYEING** Cellulose Nylon Silk Wool
		PRINTING
		FASTNESS PROPERTIES Fibre Method Alkali Burnt Gas Fumes Carbonising — Alkaline rinse Neutral rinse Decatising Light — $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Peroxide Bleach — Alteration Staining Perspiration — Alteration Staining Soda Boil — Alteration Staining Washing — Alteration Staining
		OTHER PROPERTIES Dischargeability Effect of Metals — Copper Iron Reactions in Substance H_2SO_4 conc. Dilute HCl Dilute NaOH
		NON-TEXTILE USAGE
		NOTES

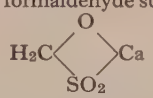
REDUCING AGENTS

The inclusion of a section on reducing agents in the Colour Index may seem to be a little out of place at first sight, as these products are in no sense colorants. On the other hand they are indispensable for the application of vat dyes and are necessary for the production of most printed discharge effects. They are also widely used as stripping agents. For these reasons it has been thought advisable to give some information relating to the constitutions and use of the various products available for these purposes.

No attempt is made to furnish any detailed particulars of methods of application, which are outside the scope of the Colour Index, but brief indications are given of the main types of usage to which each product may be put by dyers or printers.

C.I. Reducing Agent	CONSTITUTION	USAGE
1	Sodium dithionite (sodium hydrosulphite) $Na_2S_2O_4$ or $Na_2S_2O_4 \cdot 2H_2O$	Application of vat dyes. Stripping dyed cellulose Reduction clearing of polyester dyeings
1:1	C.I. Reducing Agent 1+ sodium carbonate	Bleaching wool and as a stripping agent
1:2	C.I. Reducing Agent 1+ sodium tetraphosphate	Bleaching wool, nylon, straw, feathers, etc. and as a stripping agent where strong alkali cannot be used
1:3	C.I. Reducing Agent 1+ sodium pyrophosphate or sodium polyphosphate	Bleaching wool, bristles, straw, etc.
1:4	A synergistic mixture of C.I. Reducing Agent 1, dispersing agents and surfactants	Reduction clearing of dyed or printed synthetic-polymer fibres
1:5	C.I. Reducing Agent 1+ a stabiliser	Application of vat dyes
2	Sodium formaldehyde sulphoxylate $NaHSO_2 \cdot CH_2O \cdot 2H_2O$ (or $\cdot H_2O$)	Discharge printing in general. Direct printing of vat dyes. Stripping dyed wool and silk
2:1	C.I. Reducing Agent 2 + C.I. Pigment White 4 or 5	Discharge printing, particularly on wool
2:2	C.I. Reducing Agent 2 + dimethylbenzylphenyl ammonium chloride or the sodium or calcium salt of its disulphonic acid	Discharge printing of vat dyes
3	This C.I. Generic Name is discontinued, the agents formerly listed under it now appear under C.I. Reducing Agent 2:1	
4	Zinc formaldehyde sulphoxylate insoluble in water, but soluble in acid. $Zn(OH)HSO_2 \cdot CH_2O$	Stripping
5	This C.I. Generic Name is discontinued, the agents formerly listed under it now appear under C.I. Reducing Agent 2:2	
6	Water-soluble zinc formaldehyde sulphoxylate $Zn(HSO_2 \cdot CH_2O)_2$	Stripping and discharge printing particularly on acetate, triacetate and nylon

C.I. Reducing Agents

C.I. Reducing Agent	CONSTITUTION	USAGE
7	This C.I. Generic Name is discontinued, the agents formerly listed under it now appear under C.I. Reducing Agent 1:1	
8	This C.I. Generic Name is discontinued, the agents formerly listed under it now appear under C.I. Reducing Agent 1:2	
9	Zinc acetaldehyde sulphoxylate — difficultly soluble in water $Zn(OH)HSO_2 \cdot CH_3CHO$	Gives stable solutions which reduce at 80°C
10	This C.I. Generic Name is discontinued, the agents formerly listed under it now appear under C.I. Reducing Agent 1:3	
11	Thiourea dioxide (formamidine sulphinic acid) $(NH_2)CSO_2$	Printing of vat dyes and discharge printing, particularly on acetate, triacetate and wool
12	Calcium formaldehyde sulphoxylate (water insoluble) 	Discharge printing of acetate, triacetate, nylon, wool, silk, and their blends with one another or with cellulose.
13	Sodium nitrilo-tri-1-ethansulphinate $Na_3N(CH_3CHSO_2)_3$ ***Literature*** Senner & Schirm, *Textil Praxis* **20** (1965) 1006	Vat-print fixation by the flash-age process

SOLVENT DYES

Solubility in an organic solvent (or solvents) is a characteristic physical property of a solvent dye. There are however important applications in which the solvent dye is incorporated directly into the product to be coloured.

Chemical Constitution of Solvent Dyes

Commercial solvent dyes are drawn from a number of chemical groups. Among the yellow, orange, brown and red hues azo dyes predominate but xanthene dyes provide important bright red shades. The violet dyes are provided from the azo, anthraquinone, xanthene and triarylmethane groups. Among the more bathochromic hues, however, azo dyes have few representatives and the blue and green solvent dyes are predominantly of the anthraquinone and triarylmethane groups supported by examples from the azine, thiazine and phthalocyanine groups. Blacks are provided by the very important azine dye Nigrosine supported by a number of azo dyes. As in other usage sections there are many dyes of unrecorded chemical constitution.

The features of chemical constitution associated with the special requirements of organic solvent solubility include the acid forms of certain acid dyes of the azo chromium complex and the xanthene classes and the base forms of certain basic dyes, particularly of the triarylmethane class. For use the latter are frequently dissolved in a fatty acid such as stearic or oleic acid, the fatty acid salt being thereby formed. Sulphonic acid groups as such are usually absent but dyes soluble in alcoholic solvents include salts formed between sulphonated dyes (usually azo or phthalocyanine) and organic bases of high molecular weight—such as diarylguanidine, mono- and dicyclohexylamine and diisoamylamine.

Solubility in various Solvents

A great variety of solvents is employed in the technologies which require the use of solvent dyes but for the most part they lend themselves to classification as shown below. The information concerning the solubility of C.I. Solvent Dyes has generally been given in terms of the solvents quoted as examples in this classification but many other solvents are used in technical practice, in particular higher homologues of the solvents named.

1. Alcoholic solvents, e.g. ethanol and methanol.
2. Ethers, esters and ketones, e.g. 'Cellosolve,' ethyl acetate, acetone.
3. Hydrocarbons, both aliphatic and aromatic, e.g., white spirit, mineral oil, turpentine, benzene, toluene, xylene.
4. Chlorinated hydrocarbons, e.g. carbon tetrachloride, tetrachloroethylene (perchloroethylene), trichloroethylene and 1,1,1-trichloroethane.
5. Oils, fats and waxes, e.g. linseed oil, oleic acid, stearic acid, paraffin wax.

It is common practice to use mixed solvents in order to obtain the requisite physical properties and in particular a high power of solvation.

Solubilities of C.I. Solvent Dyes are expressed either on the relative scale: very soluble, soluble, slightly soluble (with the occasional use of very slightly soluble) or as percentage solubility. The figures given for percentage solubility represent the weight of the dye in grams which after dissolving in 100 ml. of the solvent will remain in solution at room temperature. It will be seen that in some instances the percentage solubilities given by manufacturers vary over a considerable range. Solubility may in fact be greatly influenced by the use of technical, as distinct from chemically pure, solvents and by the presence in the dye of deliberate or accidental additions such as homologous or isomeric dyes. Therefore the figures given must be treated not as accurate values but as indications only of the order of solubility to be expected.

Fastness Properties

Except for solubility in organic solvents the properties required in a solvent dye are comparable to those required of colouring matters for other uses, viz. appropriate hue and resistance, in the course of processing and in the coloured article, to such agencies as water, alkalis and acids, light and heat. However, it must be emphasised in the case of solvent dyes that the incidence of these agencies is greatly affected by the particular conditions of use and that the importance of differences in fastness is subject to the great variety of purposes served. The information given on fastness properties of C.I. Solvent Dyes must therefore be read as giving no more than a general picture of the scope of usefulness of any particular dye.

Water. The term 'insoluble' has been used only when that is strictly correct at room temperature: in other cases fastness to water is described as very good (or slightly soluble or bleeds slightly), good, fair or poor. 'Very good', 'slightly soluble' or 'bleeds slightly' mean that although the dye is not completely insoluble in water its solubility is so slight that for most purposes it can be tolerated.

Alkalis and Acids. 'Unaltered' (abbreviated in the tables to Unalt) means that the dye exhibits neither solubility nor change of shade in its usual applications when exposed at the room temperature to the alkali or acid stated, usually Na_2CO_3 (5% solution of anhydrous sodium carbonate) or HCl (5% solution of concentrated hydrochloric acid). When there is some degree of solubility, i.e. bleeding occurs in alkali or acid, fastness is rated as very good, good, fair or poor according to the degree of bleeding, and alteration in shade, if any is known, is mentioned in parentheses.

Light. Fastness to light is described according to the relative scale: excellent, very good, good, fair, poor—qualified, when the information is available, by the name of the solvent to which it refers. It must again be emphasised, particularly in respect to fastness to light, that the fastness of solvent dyes is greatly affected by the particular circumstances of their

application and that the information recorded provides only a general indication.

Heat. The application of heat may bring about decomposition, melting or sublimation of a dye. The information available has therefore been expressed whenever possible in terms of (1) the temperature up to which the dye is stable, (2) the melting point and (3) the temperature above which sublimation is noticeable and so may become serious. Stability may be influenced by the medium in which a dye is incorporated, and in some cases the information has been related to a specified medium.

Uses of Solvent Dyes

Solvent dyes are used for a great variety of purposes and new uses are constantly being found as new materials are brought into manufacture. The following, however, are the principal established uses:

Spirit and oil wood stains and varnishes.

Transparent lacquers incorporating nitrocellulose, cellulose acetate, vinyl, alkyd or other synthetic resins or shellac. These are used for many purposes including foil printing.

Inks, for rotogravure and rubber stereo printing; for coating copying paper and typewriter ribbons; for ball point pens, and in printing inks as shading and brightening agents and for double tone effects.

In fats, oils and waxes of all kinds for candles, sealing waxes, and polishes and surface finishes for a great variety of materials.

For mass coloration of moulding powders and other constructional materials of cellulose acetate, celluloid, polystyrene, polymethacrylates, poly(vinyl chloride) (PVC), phenol formaldehyde (P/F), urea formaldehyde (U/F), aminoplastics or other synthetic polymer compositions.

In the leather industry for production of 'aniline' and 'semi-aniline' upper leathers and for spray finishing of dyed or undyed suede tannages. They are also used to correct off-shade dyeings by spraying from either solvent solution or aqueous/organic solvent emulsions. Solvent dyes are also used for paddle dyeing of furs and woolskins.

Considerable interest has recently been shown in the use of solvent soluble dyes for dyeing of textiles, employing new techniques. The chlorinated hydrocarbon solvents have attracted most attention for this particular application.

Some minor or specialised uses include the colouring of soap, cosmetics, petrol and other fuel oils and signalling smokes.

In addition to the dyes which have been dealt with in some detail in the solvent dyes section there are a number of textile dyes, the majority of them basic dyes, which have minor uses as solvent dyes. These are listed at the end of this section and brief notes of their solvent use will be found under the heading of non-textile uses in the C.I. Basic Dye or other appropriate textile dye section.

Literature

Because of the variety of applications of solvent dyes, the information concerning them is widely scattered in the literature. Many of the applications, however, are closely related to those of pigments and attention is therefore called to the literature listed at the end of the preamble to C.I. PIGMENTS (p. 3269).

Information on signalling smokes, chiefly concerned with chemical composition, will be found in the reports on German industry, *CIOS* File XXXII–58, items 3, 7 and 17 and *CIOS* File XXVII–84, items 8 and 32 and in *Chemical Engineering News*, **22** (1944), 1990, 2056.

Dyes which give fluorescent solutions in oils and dyes which fluoresce in substance when illuminated by light of short-wave length are referred to under 'Fluorols' and 'Lumigens' in *BIOS* 959, 9, 97; *BIOS* 987, 160, 174–5, 186–8; *BIOS* 1433, 107; *CIOS* XXVII–84, 51; *FIAT* 1313, **3**, 348.

The use of solvent soluble dyes in the finishing of leather is referred to by G. H. Geister, *J.A.L.C.A.*, 1965, 51, 523.

A large number of technical papers and patents concerning the solvent dyeing of textiles have already been published. The subject was discussed at the Shirley International Seminar, on 'Solvent based processing of textiles' (Shirley Institute, Manchester, 1969) and by B. Milicevic, *Textilveredlung*, 4 (1969), 213, *Idem.*, Soc. of Dyers and Colourists, Review of Progress in Coloration, Vol. 1 (1969), 49.

C.I. Solvent Yellow	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
1	11000	Monoazo	Greenish→ Reddish Yellow	Good (mineral oil)	125	140	Good–v. good	V. good	Good (reddens)	Spirit lacquers and varnishes; wax products; oil stains; styrene resins
2	11020	Monoazo	Yellow→ Reddish Yellow	Fair (paraffin wax)	113·5–115	120 (175 polystyrene resin)	Poor	V. good	Poor (fairly soluble)	Polishes and other wax products; polystyrene, petrol and soap. Used as indicator
3	11160	Monoazo	Yellow	Fair	100	sublimes above 150	VSS	VSS	Poor (reddens)	Shoe and other wax polishes
4	11350	Monoazo	Bright Reddish Yellow→ Bright Yellowish Orange (Mineral oil)	V. good (mineral oil)	109	75 (oil varnish)	Insol	Unalt	Poor (violet solution)	Oils, fats and waxes; oil varnishes
5	11380	Monoazo	Reddish Yellow→ Orange	Good (mineral oil)	102	90	Insol	V. good	Good (deepens)	Oil and spirit products
6	11390	Monoazo	Reddish Yellow→ Orange	Good (mineral oil)	122	70 (oil varnish) does not sublime	Insol	V. good	V. good (slight red bleed)	Oil and spirit products
7	11800	Monoazo	Bright Yellow	Good (waxes)	—	160	VSS	—	—	Varnishes, fats, waxes, resins and soaps
8	11810	Monoazo	Reddish Yellow	Good (waxes)	—	—	Insol	—	—	Varnishes, fats and waxes
9	11870	Monoazo	Greenish Yellow	V. good (waxes)	—	—	VSS	—	—	Varnishes, fats and waxes
10	11840	Monoazo	Greenish→ Reddish Yellow	Fair (mineral oil)	126–128	70 sublimes above 170	V. good	V. good (hue unalt)	V. good (hue unalt)	Oils, fats and waxes; alcoholic solvents, cellulose lacquers
11	11850	Monoazo	Greenish Yellow	—	—	—	VSS	—	—	Oils, fats and waxes; alcoholic, ester and hydrocarbon solvents
12	11860	Monoazo	Bright Greenish→ Reddish Yellow	V. good (mineral oil)	97	80 sublimes above 140	Insol	Unalt	Unalt	Mineral oil; oils, fats and waxes
13	—	Azo (Metal complex)	Reddish Yellow (NC lacquer)	—	—	—	—	—	—	Spirit lacquers and plastics
14	12055	Monoazo	Reddish Yellow	Poor–fair	134	140 sublimes above 100	V. good	Good	V. good (redder)	Hydrocarbon solvents Oils, fats and waxes, shoe and floor polishes, cellulose ester varnishes, styrene resins, petrol and soap Also coloured smokes
15	19120:1	Monoazo (Amine salt)	Greenish Yellow (NC lacquer)	V. good (NC lacquer)	—	Does not sublime	VSS	—	—	Alcoholic solvents Lacquers for metal foil printing; paper printing; celluloid, cellulose acetate, PVC and polystyrene plastics

SOLUBILITY IN																	C.I. Solvent Yellow
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
S	S	—	S	VS	S	VS	S	—	—	SS	S	SS	S	SS	S	SS	S	1
3–5	2·8	—	—	S	0·5–1	2	2·6–5	—	—	0·1–1	1·5–4·5	0·5–2	1·2–3	S	1·5–10	0·4–1·5	0·75–1·65	2
8	5·8	—	—	VS	5	8	1·5–5	—	—	0·5	5	0·5	3·6	S	8	0·5	4–6	3
S	S	—	—	—	S	S	S	—	—	S	S	S	S	—	S	S	S	4
1·9	2·1	4·3	—	—	3·2	—	4·5	—	—	SS	3·5	SS	5·7	VS	S	1·4	4·5	5
3·75	3·5	9	—	—	1	—	2·5	—	—	SS	3·0	SS	2·1	VS	6·5	SS	2·1	6
1·2	1·2	—	—	—	2	2	3	—	—	0·8	10	3	1·6	—	8	0·5	—	7
3	3·4	3·5	—	—	2·7	1	0·8	—	—	0·6	4·3	0·2	2	—	4	0·1	—	8
9	19	11·5	—	—	2·4	3	3·5	—	—	0·5	8	10	5	—	7	3	—	9
VS	S	—	—	—	S	S	S	—	—	SS	S	S	S	—	S	SS	S	10
—	—	—	—	—	S	—	—	—	—	—	S	—	—	—	—	—	—	11
S	S	—	—	—	S	S	S	—	—	S	S	S	S	—	S	S	S	12
S	Insol	—	—	S	S	S	—	VS	—	—	—	—	Insol	Insol	—	—	—	13
0·3–2	2·5–4·7	2	—	—	0·5	1·2	1·7–2·7	—	—	0·3–0·75	1·4–2·25	0·2–2·2	VS	S	7–8	0·4–0·75	1·2–5·6	14
VSS	VSS	—	—	—	1·9	VSS	Insol	13·0	7·0	Insol	—	—	VSS	Insol	Insol	—	—	15

C.I. Solvent Yellow	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
16	12700	Monoazo	Bright Greenish Yellow (NC lacquer)	Good (mineral oil)	157	70 (oil varnish) 100 (stearin and paraffin wax) sublimes above 100	Insol	Good (becomes brownish)	Unalt	Alcoholic, ester and hydrocarbon solvents and in oils, fats and waxes. Shoe creams and polishes, candles, spirit, cellulose and synthetic resin lacquers
17	—	Monoazo	Greenish Yellow (Cellulose acetate)	Good (spirit lacquer)	115–119	120 (alkyd resin lacquer) 175 (polystyrene) sublimes above 100	VSS	Fairly good (sl. duller)	Good (sl. redder)	Alcoholic, ester and hydrocarbon solvents and in oils, fats and waxes. Spirit and cellulose lacquers; NC, cellulosic acetate, polymethacrylic, polystyrene, P/F and amino plastics; wood stains, wax polishes stains and candles
18	12740	Monoazo	Bright Yellow→ Bright Reddish Yellow (Mineral oil)	Good (mineral oil)	155	90 (oil varnish) sublimes above 210	Insol	Unalt	Unalt	Ester and hydrocarbon solvents Oils, fats, waxes, candles and soap
19	13900:1	Monoazo	Yellow	V. good (spirit lacquer)	—	170	Poor	S	Unalt	Alcoholic and ester solvents; NC, spirit and synthetic resin lacquers; paper printing; cellulose acetate, celluloid and PVC plastics; rubber stereo inks, wood stains
20	14070	Monoazo	Bright Yellow (Spirit varnish)	Good (spirit varnish)	—	150 (spirit varnish)	V. good	V. good	Unalt	Alcoholic and ester solvents; oils, fats and waxes. Alcoholic varnishes. (Formerly used as a mordant dye)
21	18690	Monoazo	Yellow	V. good	>180	180 (spirit lacquer) no sublimation	V. good	Unalt	Unalt	Alcoholic solvent. NC, spirit and synthetic resin lacquers (metal foil printing); rubber stereo inks; wood stains
22	—	Monoazo	Greenish Yellow (NC lacquer on aluminium foil)	—	—	—	—	—	—	Lacquers and plastics
23	—	Monoazo	Yellow (Cellulose acetate)	Excellent	—	200 (polyvinyl acetate) sublimes above 20	V. good	—	S	Ester solvents (strong colouration), cellulose acetate, polymethacrylic; polystyrene, P/F and amino plastics. Has good U.V. absorption (cellulose acetate)
24	—	Monoazo	Bright Yellow	Good (spirit lacquer)	138·5–139·5	120 (alkyd resin laquer) some sublimation above 100	Poor	Unalt	Unalt	Benzene and oils, fats and waxes; polishing creams and other wax products
25	—	Monoazo	Reddish Yellow (Cellulose acetate)	V. good (cellulose acetate)	—	160 (alkyd or vinyl resin) no sublimation	Poor	—	—	Alcoholic, ketone and ester solvents; NC and cellulose acetate moulding powders; NC lacquers (metal foil printing); synthetic resin lacquers; paper printing

SOLUBILITY IN																	C.I. Solvent Yellow
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
1·12	6·2	2·2	—	—	0·25	—	1·5	—	—	0·5	1·5	1·5	VS	—	3·8	0·38	4·5	16
6·0	6·0	6·0	—	—	0·5	—	0·5	—	4·5	0·3	2·4	0·3	1·0	—	3·0	Trace	1·0	17
S	S	—	—	—	SS	S	S	—	—	S	—	S	S	S	S	S	S	18
0·1–2·0	VSS	1·0–2·0	Insol	S	1·0–1·5	—	VSS	S	—	VSS	VSS	VSS	VSS	Insol	VSS	VSS	—	19
S	SS	—	—	—	S	S	S	—	—	Insol	S	Insol	SS	—	S	Insol	SS	20
0·5	0·05	1·0	—	—	0·7	—	VSS	—	—	VSS	VSS	VSS	VSS	—	VSS	VSS	VSS	21
SS	Insol	—	—	S	S	SS	Insol	S	—	—	—	—	Insol	Insol	—	—	—	22
0·5	—	0·5	—	—	0·45	—	—	—	1·4	—	—	—	0·1	—	—	0·05	—	23
0·2	5·5	1·2	—	—	0·25	—	0·6	—	—	0·3	0·9	2·0	0·4	—	3·5	0·1	0·4	24
10	—	4·5	—	—	5	—	—	—	10	—	—	—	Insol	—	—	Insol	—	25

C.I. Solvent Yellow	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
26	—	—	Reddish Yellow	Fair	—	120 (resin)	Insol	V. good	V. good	Alcoholic and ester solvents; oils, fats and waxes; cellulose ester varnishes
27	—	—	Greenish Yellow	V. good (cellulose ester)	—	120 (resin)	Insol	V. good	—	Ester and hydrocarbon solvents; cellulose ester varnishes. Some use in oils, fats and waxes
28	20010	Disazo	Yellow→ Orange (Mineral oil)	V. good (mineral oil)	117	100 (varnish) sublimes above 180	V. good	V. good (no shade change)	V. good (no shade change)	Alcoholic, ester and hydrocarbon solvents Oils, fats and waxes
29	21230	Disazo	Greenish Yellow	—	—	—	—	—	—	Rotogravure and heat set inks; oil and varnish stains; vinyl lacquers on foil; petrol and paraffin wax and stearin products
30	21240	Disazo	Yellow	Fair–good (litho varnish)	115	80 some sublimation above 115	Insol	V. good	Good–v. good	Double tone printing inks. Also oils, fats and waxes; in hydrocarbon solvents; polishes, candles and in some plastics
31	—	Disazo	Greenish Yellow	Fair–good (spirit lacquer)	104–110	150–160 alkyd resin lacquer	Insol	Unalt	Unalt	Oils, fats and waxes Intaglio inks. In thermoplastics, spirit and synthetic resin lacquers, wax preparations
32	48045	Azomethine	Bright Greenish Yellow (NC lacquer)	V. good	>180	150 (resin lacquers)	V. good	S	Unalt	Alcoholic solvents. NC, spirit and synthetic resin lacquers (metal foil printing); rubber stereo inks; wood stains
33	47000	Quinoline	Bright Greenish Yellow	Fair (spirit lacquer)	≯160	180 sublimes above 160	Insol	Unalt	Unalt	Spirit lacquers, polystyrenes, polycarbonates, polyamides and acrylic resins, cosmetics, coloured smokes. Occasionally in hydrocarbon solvents
34	41000:1	Ketone Imine	Bright Greenish Yellow	Poor	120	70 sublimes above 100	Poor	Good (some bleeding)	Fair (becomes browner)	Oils, fats and waxes and alcoholic solvents Polishing waxes, spirit shellac lacquers; ball point pen inks, carbon papers, typewriter ribbons
35	—	Ketone Imine/ Methine	Greenish Yellow (Cellulose acetate)	V. good (cellulose acetate)	—	120	Insol	—	—	Alcoholic, ester and hydrocarbon solvents Cellulose acetate, polymethacrylic and polystyrene moulding powders; vinyl and alkyd resin lacquers
36	—	Acid/Basic dyestuff complex	Bright Greenish Yellow (Spirit varnish)	V. good (spirit varnish)	170	above 150 (spirit varnish) does not sublime	V. good	Poor	V. good (no shade change)	Alcoholic varnishes and cellulose and other lacquers
37	—	Acid/Basic dyestuff complex	Bright Reddish Yellow (Spirit varnish)	Good (spirit varnish)	178–190	above 150 sublimes above 210	V. good	V. good	Poor	Alcoholic solvents Spirit varnishes and cellulose and other lacquers

SOLUBILITY IN																	C.I. Solvent Yellow
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
20	10	20	—	—	10	—	3	—	—	—	10	1	—	—	10	3	—	26
10	10	10	—	—	5	—	—	—	—	1	3	3	—	—	3	—	—	27
S	S	—	—	—	S	S	S	—	—	S	S	S	S	—	S	S	S	28
VS	VS	—	S	VS	SS	VS	S	SS	—	S	VS	S	VS	S	VS	S	S	29
3·5–10	3·5–20	3·5–20	—	—	0·8–2	—	3·2–10	—	—	0·6–1	4·8–33	0·2–1	3	10	3·8–33	0·1–2	—	30
1·0	2·0	3·0	—	—	0·1	—	5·5	—	—	6·0	5·0	4·5	2·0	—	10	1·0	2·0	31
SS	0·04	0·04	—	—	7·0	SS	0·04	—	—	0·04	0·04	0·04	0·04	—	0·04	0·04	0·04	32
S	S	—	—	—	SS	SS	SS	—	—	SS	SS	SS	S	SS	SS	SS	S	33
S	SS	—	—	—	VS	SS	SS	—	—	Insol	16–20	VSS	S	—	16–20	VSS	VSS	34
1·0	—	0·5	—	—	0·5	—	—	—	3·0	—	—	—	5·0	—	—	VSS	—	35
S	Insol	—	—	S	S	SS	SS	S	—	Insol	SS	Insol	Insol	—	SS	Insol	Insol	36
S	SS	—	—	S	S	Insol	SS	S	—	Insol	Insol	Insol	Insol	—	Insol	Insol	SS	37

C.I. Solvent Yellow	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
38	—	Acid/Basic dyestuff complex	Bright Yellow (Spirit varnish)	Excellent (spirit varnish)	142	above 150 (spirit varnish) does not sublime	Insol	Poor (no shade change)	V. good (no shade change)	Alcoholic solvents Spirit varnishes and cellulose and other lacquers
39	—	—	Dull Yellow	—	—	—	—	—	—	Thermoplastic resins
40	—	—	Yellow	—	—	—	—	—	—	Thermoplastic resins
41	—	—	Greenish Yellow	—	—	—	—	—	—	Thermoplastic and thermosetting resins and cellulose esters
42	—	—	Bright Greenish Yellow	—	—	—	Insol	—	—	Lacquers
43	—	—	Greenish Yellow (NC lacquer on aluminium foil)	—	—	—	—	—	—	Lacquers and plastics
44	—	—	Bright (Fluorescent) Greenish Yellow	—	—	—	—	—	—	Lacquers and plastics; fluorescent effects in resins and plastics. SS in U/F resin. Use as Disperse dye: C.I. Disperse Yellow 11
45	—	—	Bright Greenish Yellow	—	—	—	SS	—	—	Spirit stains, shellac solutions and lacquers especially for metal foils Plastics. Soluble in diethylene glycol
46	—	—	Yellow		—	—	—	—	—	Polystyrene, oils, wood stains
47	—	—	Yellow	Fairly good	—	175	—	—	—	Bright metal foil lacquers, plastics, wood stains (non grain-raising) Soluble in diethylene glycol
48	—	—	Greenish Yellow	V. good (cellulose ester)	—	120 (resin) some sublimation above 100	Insol	V. good	*Acetic acid* V. good	Ester and hydrocarbon solvents Cellulose ester varnishes
49	—	—	Greenish Yellow	V. good	—	120 (resin) some sublimation above 120	Insol	V. good	V. good	Alcoholic, ester and hydrocarbon solvents Oils, fats, waxes; cellulose ester and resin varnishes, printing inks
50	—	—	Greenish Yellow	Fair (resin)	—	120 (resin)	Insol	Good	V. good	Hydrocarbon solvents Cellulose ester and resin varnishes; printing inks; oils, fats and waxes
51	—	—	Reddish Yellow	Fair (cellulose ester)	—	120 (resin) some sublimation above 120	Insol	V. good	V. good	Alcoholic and ester solvents Oils, fats and waxes Cellulose ester varnishes
52	—	Nitro	Yellow (Cellulose acetate)	—	—	—	—	—	—	Cellulose acetate, polystyrene and other thermoplastic resins Soluble in pyridine

SOLUBILITY IN																		C.I. Solvent Yellow
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
S	SS	—	—	S	S	S	SS	S	—	SS	S	S	SS	—	S	Insol	SS	**38**
VS	VS	—	—	VS	S	VS	S	—	—	S	S	S	VS	S	S	—	—	**39**
VS	VS	—	—	VS	S	VS	S	—	—	S	S	S	VS	S	S	—	—	**40**
S	SS	—	—	—	S	VS	SS	—	—	SS	SS	SS	SS	SS	SS	—	—	**41**
VS	VS	—	—	—	VS	VS	S	—	—	VSS	S	SS	VS	S	S	—	—	**42**
S	Insol	—	—	S	S	S	Insol	S	—	—	—	—	Insol	Insol	—	—	—	**43**
S	VSS	—	—	S	SS	SS	VSS	SS	—	VSS	VSS	VSS	VSS	—	VSS	—	—	**44**
S	SS	—	—	*Methyl 'Cellosolve'* VS	VS	—	—	VS	—	—	—	—	—	—	—	—	—	**45**
VS	VS	—	—	—	S	—	—	—	—	—	VS	—	VS	—	—	—	—	**46**
SS	—	—	—	*Methyl 'Cellosolve'* VS	VS	—	—	VS	—	—	—	—	—	—	—	—	—	**47**
10	10	10	—	—	5	—	—	—	—	1	3	3	—	—	3	—	—	**48**
3	35	20	—	—	0·15	—	30	—	—	8	40	8	—	—	40	8	—	**49**
3	20	5	—	—	—	—	20	—	—	1	3	1	—	—	3	5	—	**50**
—	20	—	—	—	10	—	20	—	—	0·3	10	0·3	—	—	10	Insol	—	**51**
S	—	—	SS	—	SS	—	—	—	—	—	—	—	Insol	—	—	Insol	—	**52**

C.I. Solvent Yellow	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
53				This C.I. Generic Name is discontinued						
54	—	Organic salt of C.I. Acid Yellow 22	Greenish Yellow	—	—	—	SS	—	—	Alcoholic and cellulosic varnishes, ball point and other inks
55	—	Disazo	Bright Yellow	—	—	—	—	—	—	
56	11021	Monoazo	Greenish Yellow→ Yellow	—	—	—	Insol	Insol	Insol	Hydrocarbon solvents Oils, fats and waxes, especially in petrol, mineral oil and shoe polishes
57	—	Organic salt of C.I. Acid Yellow 23	Yellow	—	—	—	SS	—	—	Alcoholic and cellulosic varnishes, ball point and other inks
58	11129	Monoazo	Reddish Yellow	—	—	—	—	—	—	
59	—	Azo	Bright Yellow	V. good	—	—	Good	—	—	U/F and similar stoving enamels. Good fastness to overspraying on NC lacquer
60	—	Azo (metallised)	Yellow	—	—	—	—	—	—	In alcoholic solvents
61	—	Azo (metallised)	Yellow	—	—	—	—	—	—	In alcoholic solvents
62	—	Azo (metallised)	Reddish Yellow	Excellent (lacquer) 8 (acetate fibre)	—	200	SS	—	—	Mass colouration of acetate fibre. Transparent air drying and stoving lacquers
63	—	Azo (metallised)	Dull Yellow	Excellent (lacquer) 8 (acetate fibre)	—	200	SS	—	—	Mass colouration of acetate fibre. Transparent air drying and stoving lacquers
64	—	—	Greenish Yellow	8 (acetate fibre)	—	—	—	—	—	Mass colouration of acetate fibre
65	*18690* (Similar)	Monoazo (Chromium complex)	Yellow	V. good (NC lacquer)	—	200	Insol	Insol	Insol	Alcoholic and ester solvents. Spirit and nitro lacquers
66				This C.I. Generic Name is discontinued						
67				This C.I. Generic Name is discontinued						
68	—	Azo	Yellow	Excellent (NC lacquer)	—	300 no sublimation	—	—	—	Oils, fats and waxes; NC lacquers; mass colouration of polystyrene
69	—	Azo	Yellow	V. good	—	160	VSS	Fair	Good	Alcoholic solvents. NC, spirit and resin lacquers (especially for metal foil); rubber stereo inks; spirit wood stains

SOLUBILITY IN																		C.I. Solvent Yellow
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
																		53
—	—	<1	—	—	7	—	—	6	28	—	—	—	>1	—	—	—	—	54
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	55
—	VS	—	VS	—	—	—	—	—	—	S	S	S	VS	S	S	S	VS	56
—	—	<1	—	—	30	—	—	33	60	—	—	—	Insol	—	—	—	—	57
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	58
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	59
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	60
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	61
5	—	1	—	15	12	<1	—	—	—	—	—	—	Insol	—	—	Insol	Insol	62
2	—	10	—	10	3	<1	—	—	—	—	—	—	SS	—	—	Insol	SS	63
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	64
—	—	>0·1	—	—	1	10 *Ethylacetate (80%), ethyleneglycol, mono-ethyl ether (20%)*	—	0·5	10	—	—	—	10 *Toluene (90%), ethyleneglycol, mono-ethyl ether (10%)*	—	—	—	—	65
																		66
																		67
4·2	26	12·4	—	—	0·8	—	8·6	—	—	—	—	6·2	—	6·0	17·8	0·3	11·1	68
VSS	VSS	VSS	—	—	2·4	VSS	—	3	—	—	—	—	VSS	—	—	VSS	—	69

C.I. Solvent Yellow	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
70	—	Azo	Reddish Yellow	V. good	—	—	SS	Fair	Good	Alcoholic solvents. NC, spirit and resin lacquers (especially for metal foil); rubber stereo inks; spirit wood stains
71	—	Azo	Greenish Yellow→ Yellow	—	—	—	Insol	—	—	Ester, hydrocarbon and turpentine solvents
72	—	Azo	Bright Yellow	—	—	—	Insol	—	—	Hydrocarbon solvents for colouring petroleum products
73	—	Monoazo	Yellow							
74	—	Monoazo	Greenish Yellow	V. good	—	150	V. good	—	—	Alcoholic and ester solvents. NC lacquers (especially for metal foils), spirit varnishes, other lacquers Chemically related to C.I. Acid Yellow 11
75				This C.I. Generic Name is discontinued. Dyes formerly listed under it now appear under C.I. Solvent Yellow 44						
76	—	Monoazo (metal complex)	Reddish Yellow	V. good	—	180–200	Insol	—	—	Alcoholic and ester solvents. NC and vinyl lacquers, stoving enamels (alkyd melamine), printing inks, polystyrene, cellulosic derivatives
77	11855	Monoazo	Yellow	5 (cellulose acetate)	—	—	—	—	—	Cellulosic acetate, polystyrene and other thermoplastics Textiles: C.I. Disperse Yellow 3
78	—	Nitro-diphenyl-amine	Yellow	6–7 (cellulose acetate)	—	—	—	—	—	Cellulose acetate, polystyrene and other thermoplastics
79	—	Azo-methine	Bright Greenish Yellow	V. good (NC lacquer)	—	180	V. good	Good	Good	Alcoholic and ester solvents. Transparent air-drying, stoving and acid hardening lacquers Plastics, anodised aluminium, wood stains
80	—	Azo (metallised)	Yellow (Methanol)							
81	—	Monoazo (metal complex)	Yellow	Fair (NC lacquer)	—	—	V. good	—	—	
82	—	Monoazo (metal complex)	Reddish Yellow	V. good (NC lacquer)	—	200	V. good	Good	Good	
83	—	Monoazo (Chromium complex)	Yellow	Good	—	200	SS	—	—	Lacquers (including metallised) Good stability to top coating
84	—	Nitro	Brilliant Yellow							

SOLUBILITY IN																		C.I. Solvent Yellow
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
0·5	1	0·2	—	—	6	0·2	—	12	—	—	—	—	0·5	—	—	Insol	—	70
SS	S	—	—	SS	—	S	—	—	—	—	—	—	Insol	S	—	—	—	71
SS	S	—	—	—	—	—	—	—	—	—	—	—	S	SS	—	—	S	72
																		73
9	Insol	Insol	—	—	3·2–8	Insol	—	10	20	—	—	—	Insol	—	—	—	—	74
																		75
VS	S	—	—	VS	VS	VS	Insol	—	—	Insol	Insol	Insol	S	SS	Insol	—	S	76
S	—	—	SS	—	SS	—	—	—	—	—	—	—	Insol	—	—	Insol	—	77
S	—	—	SS	—	SS	—	—	—	—	—	—	—	Insol	—	—	SS	—	78
40	Insol	40	Insol	48–50	—	16	Insol	—	50	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	79
																		80
4	2	3	Insol	5	10	10	Insol	2	4	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	81
22	Insol	6	Insol	25–45	25	2·5	Insol	—	24	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	82
20	—	10	—	—	10	<10	—	—	70	—	—	—	SS	—	—	SS	SS	83

C.I. Solvent Yellow	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
85	—	Amino-ketone	Bright Greenish Yellow	Fairly good (resin)	270	300	Insol	Unalt	Unalt	Alcoholic and ester solvents; oils, fats and waxes; fluorescent printing inks; fluorescent effects in resins and plastics
86	—	Azo	Yellow	—	—	—	—	—	—	Mineral oil products
87	—	Disazo	Bright Yellow	—	—	—	—	—	—	Felt marker inks, candles, shoe polishes; also thermoplastic resins
88	—	Azo (metal complex)	Yellow	6	—	100 (1 hr) 180 (15 min) (varnish)	—	—	—	Transparent varnishes and printing inks for metal foil and other purposes
89	—	Azo (metal complex)	Reddish Yellow	6–7	—	140 (45 min) 200 (10 min) varnish	—	—	—	Transparent varnishes and printing inks for metal foil and other purposes
90	—	Azo (metal complex)	Yellow	7	—	140 (45 min) 180 (15 min) varnish	—	—	—	Transparent varnishes and printing inks for metal foil and other purposes
91	—	Azo (metal complex)	Reddish Yellow	7	—	70 (2 hr) 140 (45 min) varnish	—	—	—	Transparent varnishes and printing inks for metal foil and other purposes
92	—	Monoazo	Yellow	7–8	—	280 (10 min)	—	—	—	Polystyrene
93	—	Mono-methine	Yellow	V. good (poly-styrene)	—	300	V. good	V. good	V. good	Polystyrene and poly-methacrylate plastics
94	45350:1	Fluorone	Yellow	Poor (ethanol)	—	—	Insol	Fair	Unalt	Cosmetics
95	—	Monoazo	Greenish Yellow	5	—	120 (60 min)	—	—	5	Fastness: plasticised PVC 4–5; transparent regenerated cellulose 5
96	—	Nitro	Yellow	Poor (white spirit)	—	160	Insol	Insol	Insol	Hydrocarbons and other mineral oil products
97	—	Benzim-idazole	Greenish Yellow	5–6 (transparent polystyrene)	—	—	—	—	—	Polystyrene
98	—	Xanthene	Yellow	7 (poly-styrene)	—	300 (polystyrene) 280 (polymeth-acrylate)	—	—	—	Polymethacrylate, poly-styrene, polyester moulding resins; also mineral oils
99	—	Monoazo	Yellow	Excellent (poly-styrene)	—	280 (polystyrene)	Insol	Poor	V. good	Thermoplastic resins
100	—	Anthra-quinone	Greenish Yellow	V. good (poly-styrene)	—	280 (polystyrene)	Insol	Unalt	Unalt	Thermoplastic resins
101	—	Amino-ketone	Greenish Yellow	Good (poly-styrene)	—	280 (polystyrene)	Insol	Unalt	Unalt	Thermoplastic resins

SOLUBILITY IN																		C.I. Solvent Yellow
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
good	—	—	—	V.good	good	good	—	—	—	Insol	—	—	SS	—	—	—	—	85
VS	VS	—	VS	VS	VS	VS	VS	—	—	VS	VS	VS	VS	VS	VS	VS	VS	86
—	VS	—	—	—	—	—	—	—	—	—	—	—	VS	—	—	—	VS	87
8	3·5	2·5	—	3·5	2	—	—	3	15	Insol	—	—	0·8	—	—	Insol	—	88
>100	5	>100	—	—	>100	>100	—	>100	100	—	—	—	5	—	—	0·2	—	89
6	Insol	6	—	—	7	0·5	—	8	17	—	—	—	Insol	—	—	Insol	—	90
2	Insol	0·3	—	—	5	VSS	—	3·5	6	—	—	—	Insol	—	—	Insol	—	91
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	92
—	S	S	—	SS	—	SS	—	SS	—	—	Insol	Insol	S	Insol	Insol	Insol	S	93
S	Insol	—	Insol	S	S	S	Insol	—	—	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	94
5	—	—	—	—	10	5 *Ethylacetate* (80%), *Ethylglycol* (20%)	—	20	—	—	—	—	—	—	—	—	10 *Xylene* (30%), *Ethanol* (70%)	95
VS	VS	—	—	VS	VS	—	—	—	—	S	VS	VS	VS	S	VS	VS	VS	96
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	97
—	16	—	—	—	—	—	—	—	—	1·4	—	—	—	—	—	0·5	—	98
2·7	—	—	—	4·2	0·9	1·3	—	—	—	—	—	—	0·1	—	—	—	—	99
0·3	—	—	—	0·3	0·1	0·4	—	—	—	—	—	—	0·7	—	—	—	—	100
2·9	—	—	—	4·3	1·4	1·2	—	—	—	—	—	—	0·1	—	—	—	—	101

C.I. Solvent Orange	C.I. Constitution Number	Chemical Class	Hue	FASTNESS					USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
1	11920	Monoazo	Yellowish Orange	Good (paraffin, stearin or spirit lacquer)	124–170	90 (mineral oil) 170 (polystyrene) sublimes about 100	Insol	Poor (redder)	Insol	Mainly oil, fats, waxes. Polishing waxes, shoe creams (turpentine) and also phenoplastic moulding powders Foods: C.I. Orange 3
2	12100	Monoazo	Reddish Orange	Good–fair (mineral oil)	128 (recryst)	90 sublimes above 190	Insol	Unalt	Unalt	Varnishes; oils, fats and waxes. Specially manufactured brands in cosmetics
3	11270:1	Monoazo	Dull Yellowish Orange	Poor	117	90 (oil varnish) sublimes above 194	Poor	Poor	S	Mainly oils, fats and waxes for polishes. Also in alcoholic solvents
4	11320:1	Monoazo	Orange	Poor	162 163–6 (recryst)	130 sublimes above 162	V. good	V. good	Poor	In ester solvents and oils and waxes mainly as a shading colour
5	18745:1	Monoazo	Orange (NC lacquer)	Very good–excellent (NC lacquer)	—	160 (alkyd resin lacquer)	V. good	S (browner)	SS	Alcoholic and ester solvents. NC lacquer (for metal foils); alkyd resin lacquers; NC, cellulose acetate, PVC, polymethacrylic and polystyrene plastics; spirit wood stains; rubber stereo inks
6	18736:1	Monoazo	Reddish Orange (Cellulose acetate)	V. good (NC laquer)	—	175 (polystyrene 30 min) (no sublimation)	Fair	S	SS	Alcoholic and ester solvents. NC lacquers (for metal foils); alkyd resin lacquers; NC, cellulose acetate, PVC, polymethacrylic and polystyrene plastics; spirit wood stains; rubber stereo inks
7	12140	Monoazo	Reddish Orange (Lacquer)	Good	166 (recryst)	100 (oil varnish)	Insol	V. good	V. good	Mainly oils, fats and waxes and hydrocarbon solvents for polishes and candles; also in polystyrene resins. Specially manufactured brands in cosmetics
8	12175	Monoazo	Reddish Orange (Mineral oil	Good (mineral oil)	168–173 174 (recryst)	Sublimes above 205	Insol	Unalt	Unalt	Hydrocarbon solvents and oils, fats and waxes
9	11005	Monoazo	Bright Reddish Orange (Cellulose acetate)	—	—	—	Insol	—	—	Alcoholic, ester and ketone solvents. Vinyl and synthetic resin lacquers; cellulose acetate moulding powders and polymethacrylic resins
10	—	Monoazo	Reddish Orange	V. good (NC lacquer)	—	175 polystyrene (30 min)	Poor	—	—	Alcoholic, ester and ketone solvents. NC lacquers for metal foil; paper printing; alkyd and vinyl resin lacquers; cellulosic acetate, NC and polystyrene plastics

SOLUBILITY IN																	C.I. Solvent Orange
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
0·25–2·2	1–2	0·2–3	—	—	0·25–1·6	1·25	0·4	—	—	VSS	0·4–4	VSS	0·2–1	—	0·1–5	VSS	0·2–0·6	1
2·8	2·8	3	—	—	1	2	2·8	—	—	1	4	0·6	4	S	2·4	1·5	—	2
2	0·3	1·5	—	—	2	0·2	0·5	—	—	0·1	20	1	0·65	—	50	0·1	—	3
5	0·5	2	—	—	1	0·3	0·5	—	—	0·1	15	0·5	0·5	—	50	0·08	—	4
SS	Insol	0·2–0·4	—	S	3·5–7	—	VSS	—	12·5	—	—	—	VSS	Insol	—	—	—	5
1·5–5·5	—	—	—	—	2·5–7	1·7	VSS	—	—	—	VSS	—	VSS	—	VSS	VSS	—	6
0·7–1	0·5–2	0·25–1·7	—	S	SS	—	1·0–4·5	—	—	0·25–2·8	1·7–2	1	3·8–5·5	S	S	0·6–0·7	3·3–4·5	7
S	S	—	—	—	SS	S	S	—	—	SS	S	SS	S	—	S	SS	S	8
0·5	—	0·4	—	—	0·4	—	—	—	0·15	—	—	—	0·05	—	—	VSS	—	9
5	—	0·2	—	—	10	—	—	—	10	—	—	—	Insol	—	—	Insol	—	10

C.I. Solvent Orange	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
11	—	Monoazo (Cobalt complex)	Yellowish Orange (Cellulose acetate)	7 (NC lacquer)	—	160 (alkyd or vinyl resin) (does not sublime)	5	5	—	Alcoholic, ester and ketone solvents. NC lacquers for metal foil; alkyd resin lacquers; NC and cellulose acetate moulding powders; polymethacrylic resins; mass colouring acetate rayon
12	—	Monoazo	Bright Orange→ Reddish Orange (Mineral oil)	Good (mineral oil)	95–103	70 (oil varnish)	Insol	Unalt	Unalt	Alcoholic, ester and hydrocarbon solvents; oils, fats and waxes
13	26075	Disazo	Bright Yellowish Orange	V. good (waxes)	—	—	Insol	—	—	Alcoholic, ester and hydrocarbon solvents and in oils, fats and waxes
14	26020	Disazo	Dull Reddish Orange	Poor (waxes)	—	—	Insol	—	—	Oils, fats and waxes
15	46005:1	Acridine	Bright Orange	Poor	—	—	Poor	—	—	Oils, fats and waxes especially in wax polishes; occasionally in alcoholic solvents
16	45396	Xanthene	Yellowish Orange	—	—	—	Insol	—	—	Cosmetics
17	45456	Xanthene	Orange	—	—	—	Insol	S	—	Cosmetics
18	45371	Xanthene	Bright Orange	—	—	—	Insol	S	—	Cosmetics
19	—	Acid/Basic dyestuff complex	Bright Orange (Spirit varnish)	Excellent (spirit varnish)	205	>150 (spirit varnish) does not sublime	V. good	V. good	V. good	Alcoholic solvents Alcoholic varnishes and cellulosic lacquers
20	—	Azo (metal complex)	Reddish Orange (NC lacquer)	—	—	—	—	—	—	Lacquers and plastics
21	—	—	Orange	—	—	—	—	—	—	Thermoplastic resins
22	—	—	Dull Reddish Orange	—	—	—	—	—	—	Thermoplastic resins
23	—	—	Bright Orange	—	—	—	—	—	—	Lacquers
24	—	—	Yellowish Orange	Poor	—	175–200	—	—	—	Lacquers for metal foil, plastics, wood stains (non grain-raising)
25	—	—	Orange	V. good	—	175–200	—	—	—	Lacquers for metal foil, plastics, wood stains (non grain-raising), solvent inks
26	—	—	Yellowish Orange	Fair (cellulose ester)	—	120 (resin) sublimes above 120	Insol	V. good	Good	Ester solvents Mainly for cellulose ester varnishes
27	—	—	Yellowish Orange	V. good (spirit varnish)	—	120 (resin) no sublimation to 120	Insol (cold) SS (hot)	V. good	Unalt	Alcoholic solvents Spirit varnishes

SOLUBILITY IN																	C.I. Solvent Orange
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
13	—	7·2	—	20	7·5	—	—	—	7·2	—	—	—	Insol	—	—	Insol	—	11
S	VS	S	—	—	S	S	S	—	—	S	S	S	VS	—	S	S	VS	12
2·8	1·5	2·9	—	—	0·9	1·5	1	—	—	0·5	1·6	2	2	—	6	1	—	13
0·1	0·5	—	—	—	0·05	0·02	0·2	—	—	0·2	1·5	1	0·3	—	2	0·04	—	14
0·25	0·2	0·2	—	—	2	0·02	0·2	—	—	Insol	2	0·3	0·4	—	25	0·05	—	15
—	—	—	—	—	S	—	—	—	—	VSS	VSS	VSS	Insol	—	VSS	—	—	16
S	—	—	—	—	S	—	—	—	—	—	VSS	Insol	VSS	—	SS	—	—	17
S	—	—	—	—	S	—	—	—	—	VSS	VSS	VSS	Insol	—	VSS	—	—	18
SS	Insol	—	—	S	S	Insol	SS	S	—	Insol	Insol	Insol	Insol	—	SS	Insol	Insol	19
SS	—	—	—	S	S	SS	Insol	S	—	—	—	—	Insol	Insol	—	—	—	20
VS	VS	—	—	—	S	S	S	—	—	SS	S	SS	S	—	S	—	—	21
VS	S	—	—	S	SS	VS	SS	—	—	SS	S	SS	S	SS	S	—	—	22
VS	VS	—	—	—	VS	VS	S	—	—	VSS	S	SS	VS	S	S	—	—	23
SS	—	—	—	VS	VS	—	—	VS	—	—	—	—	—	—	—	—	—	24
SS	—	—	—	VS	VS	—	—	VS	—	—	—	—	—	—	—	—	—	25
10	5	10	—	—	1·4	—	0·5	—	—	0·4	2	0·4	—	—	2	Insol	—	26
Insol	Insol	—	—	10	10	—	—	—	—	Insol	—	—	—	—	—	—	—	27

C.I. Solvent Orange	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
28	—	—	Reddish Orange	Good (fat)	—	120 sublimation above 120	Insol	V. good	V. good	Oils, fats and waxes and paraffin varnishes
29	—	—	Reddish Orange (Spirit varnish)	V. good	148–154	85	Insol	Insol	Insol	Alcoholic, ester and hydrocarbon solvents; oils, fats and waxes
30	20020	Disazo	Bright Orange (Mineral oil)	V. good (mineral oil)	95–105	120 (oil varnish) does not sublime	Insol	Unalt	Unalt	Alcoholic, ester and hydrocarbon solvents Oils, fats and waxes
31	—	—	Dull Reddish Orange	—	—	—	—	—	—	Gasoline, shoe polish, candles, wood stains, lacquers, thermosetting resins
32	45365	Xanthene	Orange	—	—	—	—	—	—	Drugs and cosmetics
33	—	—	Reddish Orange	V. good (spirit varnish)	—	120 (resin) does not sublime to 120	Insol (cold) VSS (hot)	V. good	Unalt	Alcoholic solvents, especially for spirit varnishes
34	—	—	Reddish Orange	Good (cellulose ester)	—	120 sublimes above 120	Insol	V. good	good	Ester solvents, especially for cellulose ester varnishes
35	—	Anthraquinone	Bright Yellowish Orange (Cellulose acetate)	—	—	—	—	—	—	Cellulose acetate, polystyrene and other thermoplastic resins Soluble in pyridine
36	—	Metal complex	Reddish Orange	V. good	—	180	—	—	—	Alcoholic and ester solvents. Transparent NC and cellulose lacquers; polyester and polyvinyl plastics
37	—	Azo (metallised)	Orange	—	—	—	—	—	—	Alcoholic solvents
38	—	Monoazo	Bright Reddish Orange	—	—	—	—	—	—	Alcoholic varnishes and cellulosic and other lacquers, aniline inks, wood stains
39	—	Azo	Bright Orange	V. good	—	—	Good	—	—	NC, and urea formaldehyde and similar stoving lacquers. Good fastness to overspraying NC lacquer
40	—	Azo (metallised)	Orange	—	—	—	—	—	—	Alcoholic solvents
41	—	Azo (metallised)	Reddish Orange	Excellent (lacquer) 8 (acetate)	—	200	SS	—	—	Mass colouration of acetate fibre. Transparent air drying and stoving lacquers
42	This C.I. Generic Name is discontinued									
43	—	Monoazo	Reddish Orange	V. good (polyester resins)	96–98	250 sublimes above 100	Good	V. good	V. good	Hydrocarbon solvents, oils, fats and waxes. Wax polishes, synthetic plastics and unsaturated polyester resins

SOLUBILITY IN																	C.I. Solvent Orange
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
8	2	4	—	—	2	—	4	—	—	3	5	3	—	—	5	2	—	28
S	S	S	—	—	S	S	S	SS	—	—	—	S	S	—	S	SS	S	29
S	S	S	—	—	S	S	S	—	—	SS	S	SS	S	—	S	SS	SS	30
S	VS	—	—	—	SS	S	S	—	—	SS	S	SS	VS	S	S	—	—	31
—	—	Insol	—	—	SS	—	S	—	—	Insol	Insol	Insol	Insol	—	Insol	—	—	32
Insol	Insol	—	—	10	10	—	—	—	—	Insol	—	—	—	—	—	—	—	33
15	5	15	—	10	6	—	10	—	—	0·5	5	0·5	—	—	5	Insol	—	34
S	—	—	SS	—	SS	—	—	—	—	—	—	—	Insol	—	—	Insol	—	35
S	—	—	—	—	S	S	—	—	—	—	—	—	—	—	—	—	—	36
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	37
4	—	—	—	—	5	—	—	4	—	—	—	—	SS	—	—	—	—	38
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	39
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	40
14	—	<1	—	5	4	<1	—	—	—	—	—	—	Insol	—	—	Insol	Insol	41
																		42
2	7·8	—	—	5	1·4	—	5·8	—	—	3	7·9	15	—	4	20	4	10	43

C.I. Solvent Orange	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
44	—	Monoazo (metal complex)	Reddish Orange	Good	—	200	V. good	V. good	Good (yellower)	Alcoholic and ester solvents; transparent air drying or acid hardening lacquers based on NC or spirit soluble natural or synthetic resins. Plastics, anodised aluminium and spirit wood stains
45	11700	Monoazo	Orange	Fairly good	—	180	Insol	V. good	Good (greener)	Alcoholic and ester solvents; transparent air drying and acid hardening lacquers based on NC or spirit soluble natural or synthetic resins. Plastics, anodised aluminium and spirit wood stains
46	—	Azo	Reddish Orange	Good	—	160	VSS	Fairly good	Good	Alcoholic solvents. NC, spirit and synthetic resin lacquers (especially for metal foils); rubber stereo inks, spirit wood stains
47	—	Azo	Yellowish Red	Excellent	—	140	VSS	Fair	Good	
48	—	Azo	Reddish Yellow→ Yellowish Orange	Good (petroleum products)	—	260 (polystyrene)	Insol	—	—	Hydrocarbon solvents, oils, fats and waxes Petroleum products, lacquers, plastics
49	—	Amine Condensate of C.I.15510	Reddish Orange (NC lacquer)	—	—	—	—	—	—	Lacquers and plastics
50	—	Disazo–Amine complex	Orange (Spirit varnish)	V. good	—	—	Good	—	—	Alcoholic solvents Metal foil lacquers, paper printing, celluloid, cellulose acetate, PVC
51	—	Monoazo	Reddish Orange	—	—	—	—	—	—	Hydrocarbon solvents, oils, fats and waxes. Wax preparations and polishes, cellulosic ester varnishes, styrene resins, petroleum products, soaps, coloured smokes
52	26080	Azo	Reddish Orange	Good (cellulose acetate)	—	—	—	—	—	Cellulose acetate, polystyrene and other thermoplastics Soluble in pyridine Textiles: C.I. Disperse Orange 13
53	10375	Nitro	Yellowish Orange	5 (cellulose acetate)	—	—	—	—	—	Cellulose acetate, polystyrene and other thermoplastics Soluble in pyridine Textiles: C.I. Disperse Yellow 9
54	—	Azo (Chromium complex)	Reddish Orange	Good (NC lacquer)	—	200	V. good	Good	Good	Alcoholic and ester solvents. Transparent lacquers, plastics, wood stains

SOLUBILITY IN																	C.I. Solvent Orange
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
0·3	Insol	2·2	—	5·5	0·6	3·5	—	0·5	—	—	—	—	—	—	—	—	—	44
0·4	Insol	0·2	—	0·3	1·6	0·4	—	0·2	—	—	—	—	—	—	—	—	—	45
0·2	VSS	VSS	—	—	1·3	VSS	—	4	—	—	—	—	VSS	—	—	Insol	—	46
0·2	Insol	VSS	—	—	0·6	VSS	—	0·15	—	—	—	—	Insol	—	—	Insol	—	47
S	S	—	—	S	SS	S	—	—	—	S	SS	—	S	SS	SS	—	S	48
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	49
5	Insol	Insol	—	—	5	Insol	—	7·6	14·2	—	—	—	Insol	—	—	—	—	50
S	VS	S	—	—	SS	S	S	—	—	SS	S	S	VS	S	VS	SS	VS	51
S	—	—	SS	—	SS	—	—	—	—	—	—	—	—	—	—	SS	—	52
S	—	—	SS	—	SS	—	—	—	—	—	—	—	Insol	—	—	Insol	—	53
8	Insol	30	Insol	20–25	12	4	Insol	—	20	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	54

C.I. Solvent Orange 55—67

C.I. Solvent Orange	C.I. Constitution Number	Chemical Class	Hue	FASTNESS					USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
55	—	Anthraquinone	Orange	7 (polystyrene) 5–6	—	320 (polystyrene) 260 (polymethacrylate)	—	—	—	Polystyrene and polymethacrylate Strongly yellowish orange fluorescence from 0·01–0·2% dye
56	—	Monoazo (Metal complex of C.I. 18745:1)	Orange	V. good (NC lacquer)	—	180	V. good	—	—	Alcoholic and ester solvents. Transparent lacquers, plastics, wood stains
57	—	Azo (Metal complex)	Reddish Orange	7 (40%)	—	120 (60 min) 140 (45 min)	—	—	—	Transparent varnishes and printing inks for metal foils and other purposes
58	—	Azo (Metal complex)	Reddish Orange	7 (40%)	—	120 (1 hr)	—	—	—	Transparent varnishes and printing inks for metal foils and other purposes
59	—	Azo (Metal complex)	Reddish Orange	5 (5%) 6 (40%)	—	120 (1 hr) 180 (10 min) (stoving lacquer)	—	—	—	Stoving lacquers
60	—	Perinone	Yellowish Orange	7–8	—	300–320 (30 min)	—	—	—	Thermoplastics, especially polystyrene
61	—	Monoazo	Reddish Orange	Fair (gasoline)	—	—	—	Insol	Insol	Hydrocarbon solvents, oils, fats and waxes Mineral oil products
62	12714	Monoazo (1:2 Chromium complex)	Reddish Orange	—	—	—	—	—	—	In alcoholic solvents for lacquers
63	—	Thioxanthene	Reddish Orange	7 (polystyrene)	—	300 (polystyrene) 280 (polymethacrylate)	—	—	—	Polymethacrylate, polystyrene and rigid PVC; also polyester resins Strongly fluorescent
64	—	Anthraquinone	Yellowish Orange	V. good (polystyrene)	—	280 (polystyrene)	Insol	Poor	V. good	Thermoplastic resins
65	—	Anthraquinone	Yellowish Orange	—	—	—	Insol	Unalt	Unalt	Thermoplastic resins
66	—	Anthraquinone	Yellowish Orange	Poor (polystyrene)	—	280 (polystyrene)	Insol	Unalt	Unalt	Thermoplastic resins
67	—	Aminoketone	Yellowish Orange	Excellent (polystyrene)	—	280 (polystyrene)	—	Poor	Unalt	Thermoplastic resins

SOLUBILITY IN																		C.I. Solvent Orange
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	55
35	Insol	—	—	50	25	25	Insol	—	—	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	56
1	Insol	0·5	—	—	4·5	2	—	3	4·5	—	—	—	—	Insol	—	—	—	57
6·5	Insol	VSS	—	—	1	VSS	—	5	17	—	—	—	—	Insol	—	—	—	58
100	VSS	77	—	—	60	80	—	83	100	—	—	—	0·8	—	—	Insol	—	59
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	60
VS	VS	—	—	S	S	VS	—	—	—	S	—	—	VS	—	—	S	VS	61
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	62
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	63
0·3	—	—	—	0·3	0·1	0·4	—	—	—	—	—	—	0·1	—	—	—	—	64
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	65
0·3	—	—	—	0·4	0·04	0·2	—	—	—	—	—	—	0·1	—	—	—	—	66
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	67

C.I. Solvent Red	C.I. Constitution Number	Chemical Class	Hue	FASTNESS					USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
1	12150	Monoazo	Yellowish Red→ Reddish Orange	Poor–fair (spirit lacquer)	170–180	100–110 (paraffin wax, alkyd resin)	Insol	Unalt	Unalt	Solvents of most types but especially oils, fats and waxes for turpentine polishes. Polystyrene and cellulose and synthetic resin lacquers
2	12005	Monoazo	Dull Red	Fair	85	—	—	V. good	V. good	Oils, fats and waxes for polishing creams and waxes
3	12010	Monoazo	Bordeaux	Poor–fair (spirit lacquer)	146–149	120 (alkyd resin lacquer)	Insol	Fairly good	Unalt	Oils, fats and waxes Polishing waxes and creams, wood stains, moulding powders
4	12170	Monoazo	Yellowish Red	Fair	220	150 sublimes above 220	Insol	Unalt	Unalt	Oils, fats and waxes 'Carbolic' soap Pigments: C.I. Pigment Red 40
5	11385	Monoazo	Dull Bluish Red→Dull Reddish Violet	Poor (ethanol)	185·5 (recryst.)	—	V. good	—	—	Ester and hydrocarbon solvents. Varnishes, fats and waxes
6	—	Monoazo	Yellowish Red	Good (mineral oil)	167 (re-cryst)	70 (oil varnish) sublimes above 174	Insol	Unalt	Unalt	Oils, fats and waxes; also in alcoholic, ester and hydrocarbon solvents
7	—	Monoazo	Bright Bluish Red (Cellulose acetate)	Good (NC lacquer)	—	120 (alkyd resin lacquer 60 min)	V. good	—	—	Alcoholic, ester, ketone and glycol ether solvents, NC lacquer (for metal foil), vinyl and alkyd resin lacquers, cellulose acetate moulding powders, NC and polymethacrylate resins
8	12715	Monoazo (Metal complex)	Bright Bluish Red (NC lacquer)	V. good	>180	160 (spirit lacquer) does not sublime	V. good	Insol	Unalt	Alcoholic and ester solvents. NC, spirit, and synthetic resin lacquers; anodised aluminium; rubber stereo inks; spirit wood stains **Literature**: IG. *GP* 517491 (*Fr* **17**, 1817) Ciba, *BP* 293358; *FP* 648087; *GP* 535472 (Fr **18**, 1102)
9	—	Monoazo	Bright Bluish Red (Cellulose acetate)	Excellent (acetate rayon) Fair (NC lacquer)	—	120 (alkyd resin lacquer 30 min)	V. good	—	—	Alcoholic, ester and ketone solvents. NC, vinyl and alkyd resin lacquers, cellulose acetate moulding powders, polymethacrylic resins, mass colouration of acetate
10	—	Monoazo	Bright Red (Cellulose acetate)	Fair (NC lacquer)	—	120 does not sublime	V. good	—	—	Alcohol, ester and glycol ether solvents. NC lacquer, vinyl and alkyd resin lacquers; cellulose acetate moulding powders; polymethacrylic resins
11	—	Monoazo	Dull Yellowish Red (Cellulose acetate)	V. good (alkyl resin lacquer)	—	160 does not sublime	V. good	—	—	Alcoholic and ester solvents for NC, alkyd and vinyl resin lacquers; celluloid and cellulose acetate moulding powders

SOLUBILITY IN																	C.I. Solvent Red
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
0·25–0·4	0·5–1	0·1–1·5	—	—	0·05–0·1	—	0·25–1·5	—	—	0·1–0·5	0·15–1	0·2–1·6	0·3–0·6	—	0·22–5	0·05	0·2–0·5	1
VS	VS	—	—	—	S	VS	S	—	—	S	S	S	VS	—	S	S	VS	2
2·5	—	0·5	—	—	0·4	VS	1·4	—	—	0·1	1·2	SS	0·7	—	0·6	SS	0·1	3
SS	VSS	—	—	—	VSS	SS	SS	—	—	VSS	S	VSS	SS	—	S	VSS	SS	4
2	1·5	—	—	—	0·3	1	0·5	—	—	1	1·5	0·1	1	—	0·5	0·1	—	5
S	S	S	—	—	SS	S	S	—	—	SS	S	S	S	—	S	SS	S	6
2	—	2	—	—	3·5	—	—	—	6·5	—	—	—	Insol	—	—	Insol	—	7
3·5	VSS	—	—	5·0	6	3·0	VSS	—	—	VSS	S	VSS	VSS	—	S	VSS	—	8
1	—	1	—	—	2	—	—	—	5	—	—	—	Insol	—	—	Insol	—	9
2	—	1·5	—	—	0·5–1·0	—	—	—	>10	—	—	—	Insol	—	—	Insol	—	10
1·8	—	0·1	—	—	1·8	—	—	—	—	—	—	—	Insol	—	—	Insol	—	11

C.I. Solvent Red	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
12	—	Monoazo	Yellowish Red (Cellulose acetate)	Good (cellulose acetate)	—	175 (polystyrene 30 min)	Insol	—	—	Alcoholic, ester and ketone solvents. Vinyl and alkyd resin lacquers, cellulose acetate moulding powders, polymethacrylate resins and polystyrene
13	12159	Monoazo	Yellowish Red	—	—	—	—	—	—	Thermoplastic resins and cellulose esters
14	—	Monoazo	Bright Yellowish Red (Cellulose acetate)	Fairly good (cellulose acetate)	—	175 (polystyrene 30 min)	Insol	—	—	Alcoholic and ester solvents. Vinyl and synthetic resin lacquers; cellulose acetate, polymethacrylic resins and polystyrene
15	—	Monoazo	Bright Bluish Red (Cellulose acetate)	Good (cellulose acetate)	—	140 (cellulose acetate 30 min)	Insol	—	—	Alcoholic, ester and ketone solvents. Vinyl and alkyd resin lacquers; cellulose acetate moulding powders
16	—	Monoazo	Red (Cellulose acetate)	Fairly good (spirit lacquer)	71–72·5	140 (polystyrene) (cellulose acetate 30 min)	V. good	Good (slightly yellower)	Fairly good	Alcoholic, ester, ketonic and hydrocarbon solvents and oils, fats and waxes. Cellulose acetate, polymethacryclic and polystyrene plastics, wood stains, double tone lithographic inks
17	12155	Monoazo	Bright Red	Fair	—	—	Insol	—	—	Alcoholic, ester and hydrocarbon solvents, oils, fats and waxes; varnishes
18	21260	Disazo	Yellowish Red	Poor (waxes)	—	—	Insol	—	—	Ester and hydrocarbon solvents
19	26050	Disazo	Bright Bluish Red (NC lacquer)	Poor	128–131·5	100–120 (alkyd resin lacquer) sublimes above 100	Insol	V. good (slightly yellower)	Unalt	Alcoholic, ester and hydrocarbon solvents, oils, fats and waxes. Double tone printing inks, candles, mineral oils. Synthetic resin lacquers. Mass coloration of cellulose
20	—	Disazo	Yellowish Red	Fair	—	120	Insol	V. good	V. good	Oils, fats, waxes. Candles and spirit varnishes
21	—	Disazo	Bright Yellowish Red (Litho varnish)	Fair	169	70 (oil varnish) does not sublime	Insol	Unalt	Unalt	Mainly photogravure and double tone inks of good non-offsetting properties. Also ester and hydrocarbon solvents, oils, fats and waxes
22	21250	Disazo	Yellowish Red	Poor–fair (waxes)	—	120 sublimes above 120	Insol	Fairly good	V. good	Oils, fats and waxes and hydrocarbon and ester solvents. Vinyl lacquers for metal foil; rotogravure and heat-set inks
23	26100	Disazo	Yellowish Red→Red	Good	195	70 (mineral oil) no sublimation below 120	Insol	Unalt	Unalt	Mainly oils, fats and waxes; also in alcoholic, ester and hydrocarbon solvents. Occasionally in polystyrene. Used in cosmetics. Used as indicator

SOLUBILITY IN																	C.I. Solvent Red
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
4	—	2	—	—	2	—	—	—	5	—	—	—	VSS	—	—	VSS	—	12
Slightly soluble in most organic solvents																		13
0·2	—	2	—	—	0·5	—	—	—	4	—	—	—	0·03	—	—	Insol	—	14
6	—	4	—	—	0·5	—	—	—	5	—	—	—	VSS	—	—	VSS	—	15
8	10	9·1	—	—	0·4	—	2·5	—	5·3	1	2·1	0·1	1	—	6·5	0·2	1	16
0·8	2	2	—	—	0·35	0·5	2	—	—	0·2	3	2	1	—	5	0·1	—	17
0·5	4	1·5	—	—	0·08	2·5	1	—	—	0·04	3	0·1	0·8	—	1	0·08	—	18
2·5–3·5	3–10	1·1–6	—	—	0·08–0·4	—	3·2–4·5	—	—	1	3·6–5	0·5	8–10	—	3·2–3·6	0·3	0·1–1·5	19
5	16	15	—	—	1	—	7·5	—	—	0·2	33	0·2	—	—	33	2	—	20
S	S	S	—	—	SS	S	S	—	—	S	S	S	S	—	S	SS	S	21
0·15–8	2–4	3	—	SS	0·05–2	—	1–4	—	—	0·2–3	2–5	0·7–3	3	SS	3–5	0·07–2	S	22
0·07–8	0·02–3	0·25–5	—	—	0·02–0·5	—	0·4–1·5	—	—	0·03–1	0·3–5	0·21–3	0·3–1·4	—	0·2–10	0·02–1	0·25	23

C.I. Solvent Red	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
24	26105	Disazo	Red→ Bluish Red	Good	184–185 (recryst)	120 (mineral oil)	Insol	Unalt	Unalt	Hydrocarbon solvents, oils, fats and waxes for shoe and floor polishes; in petrol, oils and greases, wood stains, soap, polystyrene, NC, UF and oily resin lacquers and varnishes. Cellulose acetate and acrylic resins Also used as an indicator
				Note: Some brands are mixtures of homologous and/or isomeric dyes (e.g. with C.I. Solvent Reds 27 and 23) and the fastness and solubility properties vary accordingly						
25	26110	Disazo	Red	Good	—	150 sublimes slightly	Insol	Fairly good	Good	Alcoholic, ester and hydrocarbon solvents Oils, fats and waxes; Spirit and Zapon lacquers
26	26120	Disazo	Red	—	—	—	—	—	—	Oils, fats, waxes and petroleum products; acrylic resins
27	26125	Disazo	Bluish Red	V. good (mineral oil)	108–120	70 (oil varnish) sublimes above 200	Insol	Unalt	Unalt	Oils, fats, waxes and cosmetics
28				This C.I. Generic Name is discontinued. All information is transferred to C.I. Solvent Red 24						
29	26030	Disazo	Dull Bordeaux	Good (waxes)	—	—	V. good	—	—	Alcoholic, ester and hydrocarbon solvents; oils, fats and waxes
30	27291	Disazo Amine Salt of Acid dye	Yellowish Red	Good	—	120 (1 hr) no sublimation	V. good	Poor	Poor	NC lacquer for metal foils The parent dye is C.I. Acid Red 73
31	27306	Disazo	Red (NC lacquer)	Good	—	120 (1 hr) no sublimation	V. good	Poor	Poor	NC lacquer for metal foils; also in alcoholic solvents
32	26766	Disazo	Bluish Red	Good	—	120 (1 hr) no sublimation	V. good	Poor	Poor	NC lacquers for metal foils; also in alcoholic solvents
33	—	Disazo	Yellowish Red	Fairly good	—	175–200	—	—	—	Lacquers and plastics
34	—	—	Bluish Red	Poor	—	175–200	—	—	—	Alcoholic and ester solvents
35	16260 45170	Acid/Basic dyestuff complex	Bright Bluish Red→ Violet (NC lacquer)	Good (all media)	—	160 (spirit lacquer) does not sublime	Good	Fair	Fair	Alcoholic solvents. NC, spirit and synthetic resin lacquers. Spirit wood stains, rubber stereo inks. Anodised aluminium
36	13900 45160	Acid/Basic dyestuff complex	Bright Red (NC lacquer)	Good (varnish)	—	180 (resin)	Insol	V. good	Unalt	Alcoholic and ester solvents. Spirit and cellulosic ester varnishes, lacquers and plastics
37	—	Acid/Basic dyestuff complex	Bright Red (Spirit varnish)	Excellent (spirit varnish)	178–185	>150 (spirit varnish) sublimes above 250	Good	Good	Poor	Alcoholic varnishes and cellulosic and other lacquers

SOLUBILITY IN																	C.I. Solvent Red
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
0·15–3	0·06–5	0·12–3	—	SS	0·02–1	—	0·38–1	—	—	0·08–1	0·26–5	—	VS	S	0·2–5	0·03–1	—	24
6·6	40	20	—	—	0·75	—	12·5	—	—	2·5	10	5·6	—	—	30	—	7·5	25
VS	VS	—	—	—	SS	S	S	—	—	SS	S	SS	VS	S	S	—	—	26
S	S–VS	—	—	S	SS	S	S	—	—	SS–S	S	SS–S	S–VS	S	S	S	S	27
																		28
0·5	0·2	0·8	—	—	0·3	0·4	2	—	—	1·5	3	1	0·4	—	2	0·2	—	29
VSS	Insol	—	—	—	15	Insol	—	55	—	Insol	—	—	Insol	—	—	Insol	—	30
VSS	Insol	—	—	SS	45	VSS	Insol	15	—	Insol	—	Insol	Insol	Insol	—	Insol	Insol	31
VSS	Insol	—	—	—	10	VSS	Insol	15	—	Insol	—	Insol	Insol	—	—	Insol	Insol	32
SS	Insol	—	—	SS	S	SS	Insol	S	—	—	—	—	Insol	Insol	—	—	—	33
—	—	—	—	—	VS	—	—	VS	—	—	—	—	—	—	—	—	—	34
0·05	SS	—	—	S	5	SS	SS	6	—	SS	SS	SS	SS	Insol	SS	SS	SS	35
SS	Insol	—	—	S	10	SS	Insol	S	—	—	—	—	Insol	Insol	—	—	—	36
S	Insol	—	—	S	S	Insol	SS	S	—	Insol	SS	Insol	Insol	—	SS	Insol	Insol	37

C.I. Solvent Red	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
38	—	Acid/Basic dyestuff complex	Bright Yellowish Red (Spirit varnish)	V. good (spirit varnish)	186	>150 (spirit varnish)	Good	Good	Unalt	Alcoholic varnishes and cellulosic and other lacquers
39	—	Acid/Basic dyestuff complex	Bright Yellowish Red (Spirit) varnish	Excellent (spirit varnish)	200–212	>150 (spirit varnish)	Good	Good	Unalt	Alcoholic varnishes and cellulosic and other lacquers
40	—	Azo	Bordeaux	—	—	—	—	—	—	Intaglio inks, oil wood stains, gasoline, candles, wax polishes. Lacquers, resins, varnishes and plastics, especially polystyrene and methylmethacrylate
41	42510:1	Triarylmethane	Bright Bluish Red (Fatty acid)	Poor	—	60 (oleic and stearic acid)	V. good	Poor	Poor	Oils, fats, waxes especially for polishes ("ox blood" hue). Also in carbon papers and ball point pen inks
42	45366	Xanthene	Bluish Pink	Poor	—	—	Insol	—	Insol	Cosmetics
43	45380:2	Xanthene	Bright Yellowish Red	—	—	—	—	—	—	Cosmetics
44	45385	Xanthene	Bright Bluish Red	—	—	—	SS	—	—	Alcoholic solvents Spirit varnishes for metal foils
45	45386	Xanthene	Bright Bluish Red	Poor	—	—	S	Good	Good	Alcoholic solvents Spirit varnishes for metal foils. Cosmetics
46	45457	Xanthene	Bluish Pink	Poor	—	—	Insol	—	VSS	Cosmetics
47	45435:1	Xanthene		Fairly good	—	—	Insol	—	Good	Cosmetics Textiles: C.I. Acid Red 93
48	45410:1	Xanthene	Bright Bluish Red	Fair	—	—	Insol	—	Fair	Cosmetics. Inks and lacquers for spraying and stencil printing Textiles: C.I. Acid Red 92
49	45170:1	Xanthene	Bright Bluish Pink	Poor	160	110 no sublimation below 100	Good	VSS	VSS (bluer)	Alcoholic or ester solvents or in oleic or stearic acid; in hydrocarbon solvents or in oil, fats or waxes. Ball pen inks, rotogravure inks, carbon papers and special purposes requiring UV fluorescence. In resin for NC lacquers
50	—	Xanthene	Bright Yellowish Red (Cellulose acetate)	Poor (NC lacquer)	—	160 (alkyd resin lacquer)	V. good	—	—	Alcoholic and ester solvents. NC, alkyd and vinyl resin lacquers; NC and cellulose acetate moulding powders; polymethacrylic resins

SOLUBILITY IN																	C.I. Solvent Red
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
SS	SS	—	—	S	S	Insol	—	S	—	Insol	SS	Insol	Insol	—	SS	Insol	Insol	38
SS	—	—	—	S	S	Insol	SS	S	—	Insol	Insol	Insol	Insol	—	SS	Insol	SS	39
S	S–VS	—	S	S	SS	S	S	SS	—	S	—	S	S	S	S	SS	S	40
0·6	0·2	0·5	—	—	0·3	VSS	Insol	—	—	Insol	20	Insol	Insol	—	15	Insol	—	41
SS	—	Insol	—	—	SS	—	Insol	—	—	Insol	—	Insol	Insol	—	Insol	—	—	42
S	—	S	—	—	S	S	—	—	—	Insol	—	Insol	Insol	—	Insol	—	—	43
—	—	—	—	—	S	—	—	—	—	—	—	—	—	—	—	—	—	44
SS	Insol	—	—	—	SS	Insol	—	—	—	—	—	—	—	—	—	—	—	45
S	—	SS	—	—	S	—	Insol	—	—	Insol	—	Insol	VSS	—	Insol	—	—	46
SS	—	Insol	—	—	SS	—	Insol	—	—	Insol	—	Insol	Insol	—	Insol	—	—	47
SS	—	Insol	—	—	SS	—	Insol	—	—	Insol	—	Insol	Insol	—	Insol	—	—	48
S	VSS	—	—	—	VS	SS	—	VS	—	VSS	20	VSS	—	—	20	VSS	—	49
0·15	—	0·8	—	—	0·4	—	—	—	5	—	—	—	0·05	—	—	Insol	—	50

C.I. Solvent Red	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
51	—	Xanthene	Bright Red (Cellulose acetate)	Good (NC lacquer)	—	160 (alkyd resin lacquer 30 min) does not sublime	Poor	—	—	Alcoholic, ester and ketone solvents. NC lacquers (for metal foil printing), vinyl and alkyl resin lacquers, cellulose acetate moulding powders, polymethacrylate resins
52	68210	Anthraquinone	Bluish Red	—	—	—	—	—	—	Polystyrene, rigid PVC and acrylic resins
53	—	Anthraquinone	Bright Bluish Red (Cellulose acetate)	V. good (cellulose acetate)	—	175 (polystyrene 30 min) sublimes above room temperature	Insol	—	—	Alcoholic, ester and ketone solvents. Vinyl and alkyd resin lacquers, cellulose acetate, polymethacrylic resin and polystyrene moulding powders
54	—	—	Yellowish Red	V. good	—	120 (resin)	Insol	Good	Good	Ester solvents for cellulose ester varnishes
55	—	—	Yellowish Red	Good (cellulose ester)	—	—	Insol	V. good	Good	Ester solvents for cellulose ester varnishes
56	—	—	Bluish Pink	Good (spirit varnish)	—	120 (slight sublimation above 120)	Insol	Good	V. good	Spirit and cellulose ester varnishes
57	—	—	Bluish Pink	Good (spirit varnish)	—	120 (slight sublimation above 120)	V. good	Good	V. good	Spirit and cellulose ester varnishes
58	—	Azo	Bluish Red	—	—	—	—	—	—	Cellulose ester varnishes
59	—	—	Bluish Red	Good (resin)	—	120 (resin) some sublimation above 80	Insol	V. good	V. good	Cellulosic ester varnishes and in oils, fats and waxes
60	—	—	Bright Yellowish Red	—	—	—	—	—	—	Gasoline, polishes, candles, oil wood stains and varnishes, lacquers and thermosetting resins
61	—	—	Bluish Red→ Bordeaux	Fairly good (in fat)	—	180 (resin) slight sublimation above 120	Insol	Fair	V. good	Oils, fats and waxes and in double tone printing inks
62	—	—	Dull Bordeaux (Cellulose acetate)	Good– v. good	—	120 (resin) some sublimation above 100	Insol	V. good	Good	Cellulose ester varnishes
63	—	—	Red	—	—	—	—	—	—	Gasoline, polishes, candles, oil wood stains and varnishes, lacquers
64	—	—	Yellowish Red	—	—	—	—	—	—	Thermoplastic resins, cellulose esters and thermosetting resins
65	—	—	Bluish Pink	—	—	—	—	—	—	Thermoplastic resins

SOLUBILITY IN																	C.I. Solvent Red
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
10	—	10	—	—	1·7	—	—	—	9·6	—	—	—	1·4	—	—	VSS	—	51
SS	VS	—	—	—	Insol	Insol	Insol	—	—	Insol	VS	Insol	VS	Insol	SS	—	—	52
1·3	—	1·5	—	—	0·4	—	—	—	2·0	—	—	—	0·1	—	—	VSS	—	53
2·5	5	2·5	—	—	—	—	—	—	—	—	2	—	—	—	2	—	—	54
4	—	4	—	—	2	—	—	—	—	—	—	—	—	—	—	0·75	—	55
—	—	—	—	—	2·5	—	—	—	—	—	—	—	—	—	—	—	—	56
—	—	—	—	—	2·5	—	—	—	—	—	—	—	—	—	—	—	—	57
5	3	6·6	—	15	2·5	—	1·5	—	—	—	2	Insol	—	4	2	Insol	—	58
5	5	5	—	—	1	—	1	—	—	0·2	5	0·2	—	—	5	0·5	—	59
S	VS	—	—	S	SS	S	S	—	—	SS	S	SS	VS	S	S	—	—	60
1·5	4	3	—	—	0·5	—	3	—	—	1	20	1	—	—	20	1	—	61
4	6	4	—	—	8	—	—	—	—	—	—	—	—	—	—	—	—	62
VS	VS	—	—	SS	SS	S	S	—	—	SS	S	SS	VS	S	S	—	—	63
S	S	—	—	—	VSS	S	SS	—	—	SS	SS	SS	S	SS	SS	—	—	64
VS	S	—	—	VS	SS	S	SS	—	—	SS	S	—	S	SS	—	—	—	65

C.I. Solvent Red	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
66	—	—	Yellowish Red	—	—	—	—	—	—	Thermoplastic resins
67	—	—	Red	—	—	—	—	—	—	Thermoplastic resins
68	—	—	Bright Yellowish Red	—	—	—	—	—	—	Lacquers
69	—	—	Yellowish Red	Poor–fair	—	175–200	—	—	—	Spirit stains, shellac lacquers; bright metal foil lacquers, plastics, wood stains (non grain raising)
70	—	—	Yellowish Red	—	—	—	S	—	—	Spirit stains, shellac and other lacquers
71	—	—	Bright Bluish Red (NC lacquer)	Good	>180	160 (spirit lacquer) no sublimation	Insol	S	SS	Alcoholic solvents. NC, spirit and synthetic resin lacquers, especially for metal foils. Wood stains, rubber stereo inks, anodised aluminium
72	45370:1	Xanthene	Bright Yellowish Red	—	—	—	—	—	—	Cosmetics
73	45425:1	Xanthene	Yellowish Pink	—	—	—	—	—	—	Drugs and cosmetics
74	—	Disazo	Bluish Red	—	—	—	—	—	—	Ester, ketone and unsaturated hydrocarbon solvents. Ball point pen inks and lacquers
75	—	Monoazo	Bluish Red	—	—	—	—	—	—	Ball point pen inks
76	—	Monoazo	Red	—	—	—	—	—	—	Ball point pen inks
77	—	Disazo	Bright Yellowish Red	—	—	—	—	—	—	
78	—	Metal complex	Bluish Red	V. good	—	180	—	—	—	Alcoholic and ester solvents. Transparent NC and cellulose ester lacquers; polyester and polyvinyl plastics
79	13900 45160 45170	Acid/Basic dyestuff complex	Bright Red	—	—	—	—	—	—	Alcoholic solvents
80	12156	Monoazo	Orange→ Red	—	—	—	—	—	—	Coloration of citrus fruits
81	—	Azo (Metallised)	Red	—	—	—	—	—	—	Alcoholic solvents
82	—	Azo (Metallised)	Pink	—	—	—	—	—	—	Alcoholic solvents
83	—	Azo (Metallised)	Red	—	—	—	—	—	—	Alcoholic solvents
84	—	Azo (Metallised)	Red	—	—	—	—	—	—	Alcoholic solvents

SOLUBILITY IN																	C.I. Solvent Red
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
VS	S	—	—	—	S	SS	SS	—	—	VSS	SS	VSS	S	—	SS	—	—	66
VS	VS	—	—	VS	S	VS	SS	—	—	SS	S	SS	VS	S	S	—	—	67
VS	VS	—	—	—	VS	S	S	—	—	VSS	—	SS	VS	S	SS	—	—	68
SS	Insol	—	—	VS	VS	SS	—	VS	—	—	—	—	—	—	—	—	—	69
S	VSS	—	—	—	VS	VSS	—	—	—	—	—	—	—	—	—	—	—	70
SS	SS	SS	—	—	4	SS	SS	—	—	SS	SS	SS	SS	—	SS	SS	SS	71
VS	—	S	—	—	S	S	—	—	—	Insol	—	Insol	Insol	—	Insol	—	—	72
VSS	—	Insol	—	—	S	—	Insol	S	—	Insol	Insol	Insol	Insol	—	Insol	—	—	73
—	—	VS	—	—	—	VS	—	—	—	—	—	—	—	—	—	—	—	74
—	—	—	—	—	VS	—	—	—	—	—	—	—	—	—	—	—	—	75
—	—	—	—	—	VS	—	—	—	—	—	—	—	—	—	—	—	—	76
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	77
S	—	—	—	—	S	S	—	—	—	—	—	—	—	—	—	—	—	78
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	79
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	80
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	81
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	82
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	83
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	84

C.I. Solvent Red	C.I. Constitution Number	Chemical Class	Hue	FASTNESS					USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
85	—	Azo (Metallised)	Bluish Red	Excellent (lacquers) 8 (acetate)	—	173	—	—	—	Transparent air-drying and stoving enamels. Mass coloration (spin dyeing) of acetate fibre
86	—	—	Bright Red	Good	—	160	Insol	Good	Good	Alcoholic solvents; spirit lacquers and flexographic inks
87	—	Anthraquinone	Bright Red	V. good (polystyrene) Fair (cellulose acetate)	—	—	Insol	Insol	—	Ester solvents. Plastics, especially extruded plastics, where high heat stability is required
88				This C.I. Generic Name is discontinued						
89	—	Monoazo	Bright Red	Good	—	180	Insol	—	—	Mass coloration of cellulose acetate. Transparent foil lacquers, ball point pen inks. Also in alcoholic and ketonic solvents for printing inks
90	—	Azo (Metallised)	Bright Red	V. good (lacquers) 8 (acetate)	—	200	Insol	—	—	Mass coloration (spin dyeing) of acetate fibre. Transparent stoving lacquers
91	—	Azo (Metallised)	Bluish Red	V. good (lacquer) 8 (acetate)	—	175	SS	—	—	Mass coloration (spin dyeing) of acetate fibre. Transparent air drying and stoving lacquers
92	—	Azo (Metallised)	Yellowish Red	V. good (lacquer) 8 (acetate)	—	200	SS	—	—	Mass coloration (spin dyeing) of acetate fibre. Transparent air drying and stoving lacquers
93										
94				These C.I. Generic Names are discontinued						
95										
96	—	Azo (1:2 metal complex)	Yellowish Red	V. good	—	180	—	—	—	Alcoholic and ester solvents. Transparent NC and cellulose lacquers Polyester and polyvinyl plastics
97	—	Monoazo	Bright Bluish Red	Good (NC-based printing inks)	—	—	—	—	—	Alcoholic and ketonic solvents for printing inks and NC and vinyl lacquers
98	—	Monoazo	Red	Good (unsat. polyester resins)	117–119	250	Insol	—	—	Hydrocarbon solvents and in oils, fats and waxes. Wax polishes, synthetic plastics and unsaturated polyester resins
99	12783	Monoazo (Metal complex)	Yellowish Red	V. good (NC lacquer)	—	200 (stoving lacquer)	Insol	V. good	Good (yellower)	Alcoholic solvents Transparent air-drying, stoving or acid-hardening lacquers based on NC or spirit soluble natural or synthetic resins. Also plastics, anodised aluminium and spirit wood stains

SOLUBILITY IN																	C.I. Solvent Red
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
3	—	<1	—	3	<1	<1	—	—	—	—	—	—	Insol	—	—	Insol	Insol	85
0·8	Insol	—	—	60	4·5	—	—	—	—	Insol	—	—	Insol	—	—	Insol	Insol	86
0·2	—	—	—	—	0·2	0·2	—	—	—	—	—	—	0·2	—	—	—	—	87
																		88
10	—	<1	—	10	<1	<1	—	—	—	—	—	—	Insol	—	—	Insol	Insol	89
3	—	<1	—	2	<1	<1	—	—	—	—	—	—	Insol	—	—	Insol	Insol	90
15	—	1	—	5	12	<1	—	—	—	—	—	—	Insol	—	—	Insol	Insol	91
15	—	<1	—	6	5	<1	—	—	—	Insol	—	—	Insol	—	—	Insol	Insol	92
																		93
																		94
																		95
S	—	—	—	—	S	S	—	—	—	—	—	—	—	—	—	—	—	96
VS	SS	—	—	VS	S	S	—	—	—	—	—	—	SS	—	—	—	SS	97
2·0	1·7	—	—	2·0	0·3	—	3	—	—	1	3	1·4	—	1·2	6	0·5	1·7	98
Insol	Insol	0·1	—	5	3	Insol	—	1·2	—	—	—	—	—	—	—	—	—	99

C.I. Solvent Red	C.I. Constitution Number	Chemical Class	Hue	FASTNESS					USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
100	**12716**	Monoazo (Metal complex)	Red	Good (NC lacquer)	—	200 (stoving lacquer)	Fair	V. good	Good (yellower)	Alcoholic and ester solvents. Transparent air-drying, stoving or acid-hardening lacquers based on NC or spirit soluble natural or synthetic resins. Also plastics, anodised aluminium and spirit wood stains
101			This C.I. Generic Name is discontinued							
102	**15675**	Monoazo (Metal complex)	Bluish Red	Good (NC lacquer)	—	200 (stoving lacquer)	Good	V. good	V. good	Mainly in alcoholic and ester solvents. Transparent air-drying, stoving or acid hardening lacquers based on NC or spirit soluble natural or synthetic resins. Also plastics, anodised aluminium and spirit wood stains
103	—	Azo	Red	V. good	—	130	VSS	Fair	Good	In alcoholic solvents NC, spirit and synthetic resin lacquers; rubber stereo inks; spirit wood stains
104	—	Azo	Red	Fair	—	160	VSS	Fair	Good	In alcoholic solvents NC, spirit and synthetic resin lacquers; rubber stereo inks; spirit wood stains
105	—	Azo	Orange→ Reddish Orange	—	—	—	Insol	Unalt	—	Hydrocarbon solvents
106	—	—	Bluish Red	—	—	—	—	—	—	Alcoholic solvents
107			This C.I. Generic Name is discontinued							
108	—	—	Bluish Red	—	—	—	—	—	—	Hydrocarbon solvents and in oils, fats and waxes
109	**13900 45170**	Acid/Basic dyestuff complex	Yellowish Red	Fair	—	200 (stoving lacquer)	—	—	—	Mainly in alcoholic solvents. Transparent air drying, stoving or acid hardening lacquers based on NC or spirit soluble natural or synthetic resins. Plastics, anodised aluminium and spirit wood stains
110	*27305* (similar)	Disazo	Red	—	—	180	—	—	—	Alcoholic solvents for spirit and NC lacquers
111	**60505**	Anthra-quinone	Bluish Red (Acetate, Nylon) Yellowish Red (methyl-methacrylate, rigid PVC)	AATCC 8	—	Good	—	—	—	Plastics

SOLUBILITY IN																		C.I. Solvent Red
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
0·5	Insol	0·8	—	4·5	2·2	0·7	—	1·5	—	—	—	—	—	—	—	—	—	100
																		101
0·3	Insol	0·08	—	1·8	0·2	0·1	—	0·8	—	—	—	—	—	—	—	—	—	102
0·2	Insol	VSS	—	—	1·2	VSS	—	2	—	—	—	—	Insol	—	—	Insol	—	103
VSS	Insol	VSS	—	—	1·0	VSS	—	1·5	—	—	—	—	Insol	—	—	Insol	—	104
SS	S	—	—	Insol	—	SS	—	—	—	Insol	—	—	Insol	SS	—	—	—	105
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	106
																		107
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	108
0·2	Almost Insol	Almost Insol	—	10	1	Almost Insol	—	2·5	—	—	—	—	—	—	—	—	—	109
—	—	VSS	—	—	10	>0·1	—	10	10	—	—	—	VSS	—	—	—	VSS	110
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	111

C.I. Solvent Red	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
112	—	Acid/Basic dyestuff complex	Yellowish Red	Excellent	—	—	Good	—	—	Metal foil printing, spirit lacquers, wood stains, alcohol and ester inks for elastoprinting
113	—	Acid/Basic dyestuff complex	Yellowish Red	Excellent	—	—	Good	—	—	Metal foil printing, spirit lacquers, wood stains, inks for elastoprinting (Similar properties and usage to C.I. Solvent Red 39)
114	68415	Anthraquinone	Yellowish Red	—	—	—	—	—	—	Polystyrene and polymethocrylate
115	—	Acid/Basic dyestuff complex	Bluish Red	Fair	—	—	Poor	—	—	High solubility in all organic solvents Lacquers, spirit stains, alcohol based inks, leather finishes, paper coatings
116	—	Azo	Bright Red	4–5 (cellulose acetate)	—	—	—	—	—	Cellulose acetate; also polystyrene and other thermoplastics. Soluble in pyridine
117	11215	Monoazo	Bluish Red	6 (Cellulose acetate)	—	—	—	—	—	Cellulose acetate; also polystyrene and other thermoplastics. Soluble in pyridine
118	—	Azo (Cobalt complex)	Bluish Red	V. good (NC lacquer)	—	200	V. good	Good	Fair	Transparent lacquers based on alcohol or ester soluble resins; wood stains, plastics
119	—	Acid (Azo chromium complex/ Basic complex)	Bright Yellowish Red	Fair (NC lacquer)	—	180	Good	Fair	Fair	Transparent lacquers based on alcohol or ester soluble resins; wood stains, plastics
120	—	Azo	Dull Red (Methanol)	—	—	—	—	—	—	In alcoholic solvents
121	—	Azo (Metallised)	Red (Methanol)	—	—	—	—	—	—	In alcoholic solvents
122	—	Azo (Chromium complex)	—	Good	—	200	V. good	Good	Fair	Alcoholic and ester solvents
123	—	Monoazo (Metal complex)	Bluish Red	—	—	—	—	—	—	In alcoholic solvents
124	—	Acid/Basic dyestuff salt (metal complex)	Red	2 (NC lacquer) 6 (vinyl lacquer)	—	180 (5 min) 140 (1 hr)	VSS	—	—	Transparent stoving and foil lacquers
125	—	Monoazo	Bluish Red	Fair (NC lacquer)	190	—	Good	V. good	V. good	Alcohol and ester solvents. Nitro and vinyl inks and lacquers
126	—	Disazo	Yellowish Red	—	—	—	Insol	—	—	Felt marker inks, polishes and other wax products. Some use in thermoplastics

SOLUBILITY IN																		C.I. Solvent Red
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
7·9	Insol	Insol	—	—	13·3	Insol	—	10	—	—	—	—	Insol	—	—	—	—	112
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	113
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	114
—	—	—	—	—	—	—	—	—	>40	—	—	—	—	—	—	—	—	115
S	—	—	SS	—	SS	—	—	—	—	—	—	—	Insol	—	—	SS	—	116
S	—	—	SS	—	SS	—	—	—	—	—	—	—	Insol	—	—	Insol	—	117
6	Insol	0·6	Insol	20	42	2	Insol	—	35	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	118
—	Insol	0·6	Insol	20	0·3	0·3	Insol	0·4	20	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	119
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	120
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	121
27	VSS	—	Insol	20–25	1·8	5·5	Insol	—	—	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	122
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	123
100	—	—	—	—	1	100	—	—	100	—	—	—	<1	—	—	VSS	—	124
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	125
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	126

C.I. Solvent Red	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
127	—	Azo (Chromium complex)/ basic dyestuff complex	Bluish Pink	3	—	200	—	Unalt	Unalt	Alcoholic solvents; spirit lacquers and flexographic inks
128	—	Azo (Chromium complex)/ basic dyestuff complex	Bluish Red	3	—	250	Insol	F. good	F. good	Alcoholic solvents; spirit lacquers and flexographic inks
129	—	Azo (Metal complex)	Bluish Red	5–6 (40%)	—	120 (60 min)	—	—	—	Varnishes and printing inks, especially for metal foils
130	—	Azo (Metal complex)	Yellowish Red	6 (40%)	—	160 (20 min)	—	—	—	Varnishes and printing inks, especially for metal foils
131	—	Azo (Metal complex)	Yellowish Red	5 (40%)	—	120 (20 min)	—	—	—	Varnishes and printing inks, especially for metal foils
132	—	Azo (Metal complex)	Red	5 (40%)	—	180 (15 min)	—	—	—	Varnishes and printing inks, especially for metal foils
133	—	Azo (Metal complex)	Bluish Red	6 (40%)		100 (1 hr)	—	—	—	Varnishes and printing inks, especially for metal foils
134	—	Azo (Metal complex)	Bluish Red	4 (40%)	—	100 (1 hr)	—	—	—	Varnishes and printing inks, especially for metal foils
135	—	Perinone	Yellowish Red	7–8	—	300–320 (30 min)	—	—	—	Polystyrene and polyamides
136	—	Anthraquinone	Bluish Red	6–7	—	320 (40 min)	—	—	—	Polystyrene and polyamides
137	—	Anthraquinone	Red	—	—	—	—	—	—	Polystyrene and polyamides
138	—	Anthraquinone	Yellowish Red	V. good (polystyrene)	—	300	V. good	V. good	V. good	Plastics, especially polystyrene and polymethacrylate
139	—	Anthraquinone	Bluish Red	V. good (polystyrene)	—	300 no sublimation	V. good	V. good	V. good	Plastics, especially polystyrene and polymethacrylate
140	45430:2	Xanthene	Bluish Red	Poor (ethanol)	—	—	Insol	—	—	Cosmetics
141	45440:1	Xanthene	Bluish Red	Poor (ethanol)	—	—	Insol	—	—	Cosmetics
142	12714 and 12715	Monoazo (Metal complex)	Red	—	—	—	—	—	—	In alcoholic solvents for lacquers and varnishes
143	—	Anthraquinone	Red	Excellent (polystyrene)	—	280 (polystyrene)	Insol	Unalt	Good	Thermoplastic resins
144	—	Anthraquinone	Red	Excellent (polystyrene)	—	280 (polystyrene)	Insol	Unalt	Good	Thermoplastic resins

SOLUBILITY IN																		C.I. Solvent Red
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
5·5	—	0·9	—	—	24·5	0·5	—	29·5	23	—	—	—	0·3	0·4	—	Insol	0·2	127
24·5	—	3·5	—	—	20	1	—	20·5	20	—	—	—	0·6	1·2	—	Insol	0·6	128
9	Insol	2	—	—	7	2	—	8	12	—	—	—	Insol	—	—	—	—	129
12	Insol	1·5	—	—	10	1	—	2·5	11	—	—	—	Insol	—	—	—	—	130
8	0·2	8	—	—	5	4	—	5	8	—	—	—	0·2	—	—	—	—	131
17	VSS	8	—	—	10	5	—	8·5	20	—	—	—	Insol	—	—	—	—	132
8	Insol	0·1	—	—	1·5	0·1	—	1·5	13	—	—	—	Insol	—	—	—	—	133
3	Insol	0·5	—	—	1	0·5	—	1·5	14	—	—	—	Insol	—	—	—	—	134
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	135
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	136
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	137
Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	138
Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	139
S	SS	—	Insol	SS	S	SS	SS	—	—	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	140
VS	Insol	—	Insol	SS	VS	VS	S	—	—	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	141
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	142
0·5	—	—	—	0·3	0·1	0·5	—	—	—	—	—	—	1·0	—	—	—	—	143
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	144

C.I. Solvent Red 145—151

C.I. Solvent Red	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
145	—	Anthraquinone	Bluish Red	V. good (polystyrene)	—	280 (polystyrene)	Insol	Unalt	Unalt	Thermoplastic resins
146	—	Anthraquinone	Bluish Red	Excellent (polystyrene)	—	280 (polystyrene)	Insol	Unalt	Unalt	Thermoplastic resins
147	—	Anthraquinone	Red	Excellent (polystyrene)	—	280 (polystyrene)	Insol	Unalt	Unalt	Thermoplastic resins
148	—	Anthraquinone	Bluish Red	Excellent (polystyrene)	—	280 (polystyrene)	—	V. good	Unalt	Thermoplastic resins
149	—	Anthraquinone	Bright Bluish Red	Fair (polystyrene)	—	280 (polystyrene)	Insol	Unalt	Unalt	Thermoplastic resins
150	—	Anthraquinone	Bright Red	Fair (polystyrene)	—	280 (polystyrene)	Insol	Unalt	Unalt	Thermoplastic resins
151	—	Anthraquinone	Bluish Red	Excellent (polystyrene)	—	280 (polystyrene)	Insol	Unalt	Unalt	Thermoplastic resins

SOLUBILITY IN																		C.I. Solvent Red
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
0·07	—	—	—	0·07	0·01	0·1	—	—	—	—	—	—	0·2	—	—	—	—	145
0·09	—	—	—	0·7	0·1	1·1	—	—	—	—	—	—	1·1	—	—	—	—	146
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	147
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	148
0·06	—	—	—	0·23	0·07	0·06	—	—	—	—	—	—	0·19	—	—	—	—	149
0·05	—	—	—	0·1	0·02	0·03	—	—	—	—	—	—	0·07	—	—	—	—	150
0·08	—	—	—	0·3	0·04	0·08	—	—	—	—	—	—	0·2	—	—	—	—	151

C.I. Solvent Violet	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
1	12196	Monoazo (Metal complex)	Dull Bluish Violet (NC lacquer)	Good	>180	160 (spirit lacquer) does not sublime	Insol	Unalt	Unalt	Alcohol and ester solvents. NC, spirit and synthetic resin lacquers (metal foils); rubber stereo inks; spirit wood stains
2	16055 and 45170	Acid/Basic dyestuff complex	Bright Violet (NC lacquer)	Good	>180	160 (spirit lacquer)	Good	SS	VSS	Alcoholic and ester solvents. NC, spirit and synthetic resin lacquers (metal foils); rubber stereo inks; spirit wood stains
3	—	Acid/Basic dyestuff complex	Reddish Violet (Spirit varnish)	V. good	144–150	>150 (spirit varnish) sublimes above 200	V. good	Poor	Insol	Alcoholic varnishes and cellulose and other lacquers
4	—	Monoazo	Reddish Violet (Cellulose acetate)	Fair (NC lacquer)	—	120 (alkyd resin lacquer) 1 hr	Insol	—	—	Alcoholic solvents. NC, vinyl and alkyd resin lacquers, cellulose acetate, PVC and polymethacrylic moulding powders
5	—	Monoazo	Reddish Violet (Cellulose acetate)	Excellent (cellulose acetate)	—	140 (cellulose acetate) 30 min does not sublime	Insol	—	—	Alcoholic, ester and ketonic solvents. Vinyl and alkyd resin lacquers, cellulose acetate moulding powders
6	This C.I. Generic Name is discontinued. All information is transferred to C.I. Solvent Violet 1									
7	—	—	Bright Reddish Violet	—	—	—	—	—	—	In lacquers
8	42535:1	Triaryl-methane	Bright Bluish Violet	Poor	140	100 does not sublime	V. good	Good	Poor	In oleic, stearic or other fatty acid. Typewriter ribbons, copying papers, printing and ball point ink. Rotagravure and NC lacquers
9	42555:1	Triaryl-methane	Bright Bluish Violet	Poor	140	100 does not sublime	V. good	Unalt	Poor	In oleic, stearic or other fatty acid. Typewriter ribbons, copying papers, printing and ball point inks, rotogravure inks
10	45190:1	Xanthene	Bright Reddish Violet	Good	—	140 does not sublime <160	V. good	V. good	V. good	Alcoholic and ester solvents. Spirit lacquers, rubber stamping inks, celluloid, bakelite, cosmetics Textiles: C.I. Acid Violet 9
11	61100	Anthra-quinone	Bright Violet (Cellulose acetate)	V. good (cellulose acetate)	—	175 (polystyrene) 30 min does not sublime	Insol	—	—	Alcoholic and ester solvents. Vinyl, alkyd resin, cellulose ester lacquers; cellulose acetate, polymethacrylic and polystyrene moulding powders

SOLUBILITY IN																	C.I. Solvent Violet
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
1·5	Insol	0·4	—	—	1·5	0·4	Insol	—	—	SS	SS	Insol	Insol	—	SS	Insol	Insol	1
SS	Insol	SS	—	—	4	SS	Insol	—	—	Insol	SS	Insol	Insol	—	SS	Insol	Insol	2
S	SS	SS	—	S	S	SS	SS	S	—	Insol	Insol	Insol	SS	—	SS	Insol	SS	3
0·5	—	0·05	—	—	1	—	—	—	2·5	—	—	—	Insol	—	—	Insol	—	4
5	—	1	—	—	0·15	—	—	—	1	—	—	—	0·1	—	—	VSS	—	5
																		6
VS	VS	—	—	—	VS	S	S	—	—	SS	S	SS	VS	S	S	—	—	7
SS	SS	—	—	—	S	SS	SS	S	—	VSS	VS	VSS	S	SS	VS	VSS	—	8
SS	VSS	—	—	—	S	VSS	SS	VS	—	VSS	S	VSS	S	—	S	VSS	VSS	9
VS	SS	—	SS	—	VS	SS	SS	—	—	Insol	SS	SS	SS	SS	SS	SS	SS	10
0·5	0·75	0·2	—	—	0·5	—	—	—	0·1	—	—	—	VSS	—	—	Insol	—	11

C.I. Solvent Violet	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
12	61105	Anthraquinone	Bright Bluish Violet (Cellulose acetate)	Good (cellulose acetate)	—	175 (polystyrene) 30 min does not sublime	Insol	—	—	Alcoholic, ester and hydrocarbon solvents; vinyl and alkyd resin lacquers; Cellulose, acetate, polymethacrylic resin and polystyrene moulding powders
13	60725	Anthraquinone	Bright Bluish Violet	Good medium-full shades, light shades poor (Petrol)	—	Thermoplastic resins, full tone: good tint: poor	Insol	Unalt	Unalt	Hydrocarbon solvents. Petrol. Thermoplastic resins. Cosmetics
14	61705	Anthraquinone	Bright Violet	—	—	—	—	—	—	Oils, wax products; petrol, polystyrene, wood stains
15	—	Anthraquinone	Bluish Violet	Poor (waxes)	—	—	Insol	—	—	Varnishes, fats and waxes
16	—	—	Bluish Violet	—	—	—	—	—	—	Thermoplastic resins
17	—	—	Violet	—	—	—	—	—	—	Thermoplastic resins
18	—	—	Reddish Violet	Fairly good	—	120	Insol	V. good	V. good	Alcoholic, ester and hydrocarbon solvents; cellulose ester varnishes
19	—	Metal complex	Reddish Violet	V. good	—	180	—	—	—	Alcoholic and ester solvents. Transparent NC and cellulose ester lacquers; polyester and polyvinyl plastics
20	This C.I. Generic Name is discontinued. All information is transferred to C.I. Solvent Violet 13									
21	—	Azo (Metallised)	Violet	—	—	—	—	—	—	Alcoholic solvents
22	—	Azo (Metallised)	Reddish Violet	8 (mass coloured acetate)	—	—	—	—	—	Mass coloration (spin dyeing) of acetate fibre
23	*50325* derivative	Azine (Amine Salt of Acid dye)	Violet	Good (NC lacquer)	—	200	Insol	Poor	Insol	Alcoholic solvents; spirit and nitro lacquers The parent dye is C.I. Acid Violet 50
24	—	Monoazo	Violet	Good (NC printing inks)	—	—	—	—	—	Alcoholic and ester solvents. Printing inks, NC and vinyl lacquers; mass coloration of cellulose acetate
25	—	—	Violet	—	—	—	—	—	—	Clean-handling spirit duplicating inks
26	62015	Anthraquinone	Reddish Violet	5–6 (cellulose acetate)	—	—	—	—	—	Cellulose acetate, polystyrene and other thermoplastics Textiles: C.I. Disperse Red 11

SOLUBILITY IN																	C.I. Solvent Violet
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
0·7	—	2	—	—	0·5	—	—	—	2	—	—	—	0·3	—	—	VSS	—	12
S	S	—	—	—	SS	S	VS	—	—	VS	VS	S	VS	S	VS	SS	S	13
SS	VS	—	S	—	VSS	SS	SS	—	—	SS	SS	SS	S	SS	SS	—	—	14
0·2	0·25	1·5	—	—	0·15	0·8	1·7	—	—	1	4	1	0·2	—	5	0·15	—	15
VS	VS	—	—	VS	S	VS	S	—	—	SS	S	SS	VS	S	S	—	—	16
VS	VS	—	—	VS	S	VS	S	—	—	SS	S	SS	VS	S	S	—	—	17
1	0·75	1	—	—	1·5	—	—	—	—	—	—	—	—	—	—	—	—	18
S	—	—	—	—	S	S	—	—	—	—	—	—	—	—	—	—	—	19
																		20
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	21
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	22
—	—	VSS	—	—	10	—	—	10	10	—	—	—	VSS	—	—	—	VSS	23
VS	SS	—	—	VS	VS	VS	—	—	—	—	—	—	SS	—	—	—	SS	24
—	—	—	—	—	VS	—	—	—	—	—	—	—	—	—	—	—	—	25
S	—	—	SS	—	SS	—	—	—	—	—	—	—	Insol	—	—	SS	—	26

C.I. Solvent Violet 27—30

C.I. Solvent Violet	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
27	—	Triphenylmethane	Violet (Methanol)	—	—	—	—	—	—	Alcoholic solvents
28	—	Anthraquinone	Reddish Violet	5 (polystyrene)	—	250 (15 min)	—	—	—	Polystyrene and polyamides
29	—	Perinone	Reddish Violet	—	—	—	—	—	—	Polystyrene and polyamides
30	—	Anthraquinone	Violet	Excellent (polystyrene)	—	280 (polystyrene)	Insol	Unalt	Unalt	Thermoplastic resins

SOLUBILITY IN																		C.I. Solvent Violet
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	27
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	28
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	29
0·04	—	—	—	0·06	0·05	0·05	—	—	—	—	—	—	0·05	—	—	—	—	30

C.I. Solvent Blue	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
1	—	Monoazo	Reddish Navy (Cellulose acetate)	Fair (NC lacquer)	—	120 (alkyd resin lacquer) 60 min	Insol	—	—	Alcoholic, ester, ketone and glycol ether solvents; cellulose acetate and polymethacrylic plastics; mass coloration of acetate rayon
2	42563:1	Triaryl-methane	Bright Reddish Blue (NC lacquer)	Poor	110	110 (olein) does not sublime	Insol	Unalt	S	In oleic or stearic acid for typewriter ribbons, carbon papers and ball point inks
3	42775	Triaryl-methane	Blue	Good (ethanol)	—	—	Insol	—	—	Alcoholic solvents, oils, fats and waxes Textiles: formerly used as a Basic dye
4	44045:1	Triaryl-methane	Bright Blue	Poor	>180	110 (olein) does not sublime	Insol	Unalt	S	In oleic or stearic acid for printing inks (especially for brightening and in double tone inks), carbon papers, typewriter ribbons, stamping and ball point inks Stearate in rotogravure inks The parent dye is C.I. Basic Blue 26
5	42595:1	Triaryl-methane	Bright Blue (NC lacquer)	Poor	90	110 (oleic acid) does not sublime	Insol	Unalt	S	In oleic or stearic acid for typewriter ribbons, carbon papers, stamping and ball point inks The parent dye is C.I. Basic Blue 7
6	44040:1	Triaryl-methane	Dull Blue (NC lacquer)	Poor	>180	110 (oleic acid) does not sublime	Insol	V. good	SS	In oleic or stearic acid for typewriter ribbons, carbon papers, stamping and ball point inks The parent dye is C.I. Basic Blue 11
7	50400	Azine	Reddish Blue→ Reddish Navy	Fair	>180	110 (oleic acid) does not sublime	Insol	V. good	Poor (soluble)	In oleic or stearic acid for printing inks (especially for brightening) in carbon papers, typewriter ribbons, stamping inks, spirit varnishes and in oils, fats and waxes generally; also rotogravure and solvent inks ,NC lacquers (rosinate) and nylon moulding powders
8	52015	Thiazine	Greenish Grey	Poor (waxes)	—	—	Poor	—	—	In fatty acid, especially stearic acid, for oils, fats and waxes Textiles: see C.I. Basic Blue 9
9	—	Azine	Blue (NC laquer on aluminium foil)	—	—	—	—	—	—	Lacquers, plastics; shading ball point inks

SOLUBILITY IN																		C.I. Solvent Blue
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
2	—	1	—	—	0·8	—	—	—	5	—	—	—	VSS	—	—	Insol	—	1
VS	VS	—	—	—	VS	VS	VS	—	—	SS	VS	SS	VS	—	VS	SS	VS	2
0·25	Insol	Insol	—	—	0·6	SS	Insol	—	—	Insol	0·2	Insol	Insol	—	1·5	Insol	Insol	3
0·4	0·5	—	—	—	0·3	0·1	2	—	—	VSS	20–33	1	0·5	—	25–33	0·2	—	4
S	S	S	—	—	VS	S	S	—	—	SS	VS	SS	S	—	VS	SS	S	5
S	VS	—	—	—	S	S	2	—	—	SS	25–33	1	S	—	25–33	SS	—	6
0·3–0·8	0·3	—	—	—	0·2–0·5	0·15–0·2	2·5–3	—	—	0·2–0·5	Up to 33	0·2	—	SS	Up to 33	Insol	—	7
0·3	0·2	0·2	—	—	0·1	0·1	0·2	—	—	0·1	0·5	Insol	0·1	—	10	Insol	—	8
SS	Insol	—	—	SS	S	SS	Insol	S	—	—	—	—	Insol	Insol	—	—	—	9

C.I. Solvent Blue	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
10	—	Azine	Bright Blue (Cellulose acetate)	Fair (NC lacquer)	—	120 (alkyd resin lacquer) 60 min	Poor	—	—	Alcoholic and ether solvents. NC lacquer (for metal foils), vinyl and alkyd resin lacquers; celluloid, cellulose acetate and polymethacrylic moulding powders
11	61525	Anthraquinone	Blue	Fair (paraffin wax)	175	Sublimes above 100	Insol	Unalt	Unalt	In petrol; also mass coloration of cellulose acetate and polystyrene, rigid PVC and acrylic resins; soap coloration
12	62100	Anthraquinone	Blue	—	—	—	—	—	—	In petrol; also in coloured smokes
13	62080	Anthraquinone	Reddish Blue	—	—	—	—	—	—	
14	61555	Anthraquinone	Greenish Blue	Poor	—	—	Insol	—	—	In petrol, hydrocarbons generally and oils, fats and waxes. Hue in waxes becomes grey on long storage. Also cosmetics
15	—	Anthraquinone (1,4-dialkylamino derivative)	Bright Blue	—	—	—	—	—	—	Alcoholic, ester and hydrocarbon solvents and in oils, fats and waxes
16	—	Anthraquinone (1,4-dialkylamino derivative)	Blue	—	—	—	—	—	—	Alcoholic, ester and hydrocarbon solvents and in oils, fats and waxes. Also in thermoplastic resins
17	—	Anthraquinone (Aminohydroxy derivative)	Bright Greenish Blue (Cellulose acetate)	Good (cellulose acetate)	—	140 (cellulose acetate) 30 min	Insol	—	—	Alcoholic, ester, ketone and glycol ether solvents Cellulose acetate lacquers and moulding powders
18	64500	Anthraquinone	Blue	Good (cellulose acetate)	—	175 (polystyrene) 30 min does not sublime	Insol	—	—	Alcoholic and ester solvents. Vinyl and alkyd resin and cellulose ester lacquers; cellulose acetate and polystyrene moulding powders
19	—	Anthraquinone (Amino hydroxy derivative)	Blue (Cellulose acetate)	Poor (spirit lacquer) Excellent (cellulose acetate)	75–78	175 (polystyrene) does not sublime	Insol	F. good	Fair	Alcoholic and ester solvents, oils, fats and waxes; vinyl and alkyd resins and cellulose lacquers; cellulose acetate, polymethacrylic and polystyrene plastics; double tone lithographic inks
20	—	Anthraquinone	Reddish Blue (Plastic moulding)	—	—	—	—	—	—	Petrol, plastics, polishes, oil and wood stains, varnishes and lacquers

SOLUBILITY IN																		C.I. Solvent Blue
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
VSS	—	VSS	—	—	0·5	—	—	—	10	—	—	—	Insol	—	—	Insol	—	10
SS	S	—	—	—	SS	SS	SS	—	—	SS	SS	SS	S	SS	SS	—	—	11
S	SS	—	—	—	Insol	VSS	VSS	—	—	VSS	SS	SS	S	SS	SS	—	—	12
Insol	SS	—	—	—	Insol	Insol	SS	—	—	Insol	Insol	Insol	SS	Insol	Insol	—	—	13
S	—	S	—	S	SS	—	—	—	—	S	S	S	S	—	S	S	—	14
VS	VS	—	—	—	S	VS	S	—	—	SS	S	SS	VS	S	S	—	—	15
VS	VS	—	—	—	VS	VS	S	—	—	SS	VS	SS	VS	S	S	—	—	16
0·2	—	0·3	—	—	0·5	—	—	—	1·4	—	—	—	VSS	—	—	Insol	—	17
0·1	—	0·1	—	—	0·1	—	—	—	0·1	—	—	—	VSS	—	—	VSS	—	18
0·6	2	2	—	—	0·35	—	0·5	—	2	0·5	0·6	0·2	0·1	—	2	VSS	0·1	19
S	VS	—	—	—	S	S	S	—	—	S	—	VS	VS	S	VS	—	—	20

C.I. Solvent Blue	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
21	—	Anthraquinone (Amino derivative)	Reddish Blue (Cellulose)	Poor (spirit lacquer) Excellent (cellulose acetate)	185·5–187·5	175 (polystyrene) does not sublime	Insol	Fair (yellower)	Fair (yellower, duller)	Alcoholic, ester and hydrocarbon solvents, oils, fats and waxes Double tone lithographic inks; vinyl resin, alkyd resin and spirit lacquers; cellulose acetate, polymethacrylic and polystyrene plastics
22	49705	Indophenol	Blue	Poor (spirit lacquer)	236–238	—	Insol	V. good	Good (redder)	Alcoholic, ester and hydrocarbon solvents, oils, fats and waxes
23	42760	Triarylmethane	Greenish Blue	—	—	—	—	—	—	Alcoholic solvents; spirit varnishes. For manufacture of C.I. 42765, 42770 and 42780 Formerly used as a Basic dye for textiles
24	74380	Phthalocyanine	Greenish Blue (NC lacquer)	—	—	—	—	—	—	Lacquers and plastics
25	74350	Phthalocyanine	Greenish Blue (NC lacquer)	V. good	>180	160 (spirit lacquer) does not sublime	V. good	SS	Unalt	Alcoholic solvents. NC, spirit and synthetic resin lacquers (metal foils); spirit wood stains; rubber stereo inks; anodised aluminium
26	—	Acid/Basic dyestuff complex	Bright Reddish Blue (Spirit varnish)	Excellent (spirit varnish)	139	150 (spirit varnish) sublimes above 204	Insol	Unalt	Unalt	Alcoholic varnishes and cellulose lacquers
27	—	—	Bright Blue	Good (cellulose ester)	—	120 (resin)	Insol	V. good	V. good	Ester solvents, particularly for cellulose ester lacquers
28	—	—	Dull Reddish Blue	Fair (cellulose ester)	—	110 (cellulose ester) does not sublime	Insol	V. good	V. good	Alcohol and ester solvents; cellulose ester lacquers
29	—	—	Reddish Navy	—	—	—	SS	—	—	Alcoholic solvents
30	—	—	Bright Blue	—	—	—	—	—	—	Lacquers
31	—	—	Bright Bluish Green	—	—	—	—	—	—	Lacquers
32	—	—	Blue	—	—	—	—	—	—	Lacquers
33	—	—	Bright Reddish Blue (Spirit lacquer)	Good	130	130–140 (spirit lacquer) does not sublime	Insol	Unalt	Unalt	Alcoholic solvents Spirit lacquers and rubber stereo inks
34	—	—	Navy	Poor	—	195–225	—	—	—	Lacquers
35	—	—	Bright Greenish Blue (NC lacquer)	Fair	—	110 (paraffin wax) sublimes above 100	Insol	V. good	Becomes dirty green	Alcoholic, ester and hydrocarbon solvents, oils, fats and waxes. Transparent spirit lacquers

SOLUBILITY IN																	C.I. Solvent Blue
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
1·5	1	2	—	—	—	—	0·3	—	3	0·5	0·8	0·1	0·1	—	1	VSS	0·1	21
2	1·5	—	—	0·9	0·5	1	—	—	—	—	—	—	2	—	—	0·3	—	22
—	—	—	—	—	S	—	—	S	—	—	—	—	—	—	—	—	—	23
SS	Insol	—	—	S	S	SS	Insol	S	SS	—	—	—	Insol	Insol	—	—	—	24
0·1	SS	SS	—	—	0·6	SS	SS	—	—	SS	SS	SS	SS	—	SS	SS	SS	25
S	Insol	SS	—	S	S	—	SS	S	SS	Insol	Insol	Insol	Insol	—	SS	Insol	Insol	26
1	5	1	—	—	1	—	—	—	5	—	—	—	—	—	—	—	—	27
1	1	1	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	28
S	Insol	—	—	—	S	VSS	—	—	—	—	—	—	—	—	—	—	—	29
VS	VS	—	SS	—	VS	VS	S	—	—	VSS	S	SS	VS	S	S	—	—	30
SS	VS	—	—	—	SS	SS	VSS	—	—	Insol	SS	Insol	VS	SS	SS	—	—	31
S	VS	—	—	—	SS	—	—	—	—	—	VS	—	VS	—	VS	—	—	32
VS	SS	VS	—	—	VS	VS	SS	—	—	SS	S	SS	SS	—	S	SS	SS	33
SS	—	—	—	VS	VS	—	—	—	—	—	—	—	—	—	—	—	—	34
1	1·8	0·7	—	—	0·075	S	0·62	—	—	0·16	1·2	0·4	S	—	2·5	3·0	1·2	35

C.I. Solvent Blue	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
36	61551	Anthraquinone	Bright Blue	Excellent	—	—	—	—	—	Oils and polystyrene; acrylic resins. Textiles, see C.I. Disperse Blue 139
37	—	—	Reddish Blue	Poor	—	195–225	—	—	—	Lacquers and ball point inks
38	—	—	Bright Greenish Blue	Good	—	195–225	—	—	—	Lacquers and ball point inks
39	—	—	Reddish Blue	—	—	—	—	—	—	Ball point inks
40	—	Anthraquinone	Bright Greenish Blue	Good	—	155 (30 min)	Good	—	—	NC lacquers; vinyl resin surface coatings
41	—	Anthraquinone	Blue	Good	—	V. good fastness	Insol	Unalt	Unalt	Polystyrene
42	—	Phthalocyanine (Derivative of C.I. 74180)	Bright Greenish Blue	Good	—	—	—	—	—	Lacquers and ball point inks
43	—	Triphenylmethane	Bright Reddish Blue	Fair	—	—	Insol	—	—	Alcoholic solvents for special inks
44	—	Phthalocyanine	Greenish Blue	Fair (lacquer)	—	175	Insol	—	—	Transparent stoving lacquers. Foil lacquers
45	—	Anthraquinone	Bright Blue	Good (lacquer) 7 (acetate fibre)	—	200	Insol	—	—	Mass coloration (spin dyeing) of acetate fibre Transparent stoving and foil lacquers
46	—	Phthalocyanine	Greenish Blue	5–6 (acetate fibre)	—	—	—	—	—	Mass coloration (spin dyeing) of acetate fibre Fastness: Gas fume fading 3, Peroxide bleaching 4–5
47	—	—	—	This C.I. Generic Name is discontinued						
48	—	—	Blue	Good (spirit lacquer)	—	200	Insol	Good	Good	Alcoholic solvents Spirit lacquers and flexographic inks
49	*50315* derivative	Azine (Amine Salt of Acid dye)	Reddish Blue	Good (NC lacquer)	—	200	Insol	Poor	Insol	Alcoholic solvents Spirit and nitro lacquers Parent dye is C.I. Acid Blue 59
50	*50320* derivative	Azine (Amine Salt of Acid dye)	Blue	Good (NC lacquer)	—	200	Insol	Poor	Insol	Alcoholic and ester solvents. Spirit and nitro lacquers Parent dye is C.I. Acid Blue 102
51	—	—	Blue	V. good	—	—	—	Insol	Poor	Paper colouring. Flexographic and ball point inks
52	—	Phthalocyanine	Blue	Fair (NC inks)	—	—	—	—	—	Ketonic solvents; mass coloration of cellulose acetate

SOLUBILITY IN																		C.I. Solvent Blue
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
—	VS	—	—	—	—	S	SS	—	—	SS	SS	–	VS	SS	SS	—	—	36
SS	—	—	—	VS	VS	—	—	VS	—	—	—	—	—	—	—	—	—	37
SS	—	—	—	VS	VS	—	—	VS	—	—	—	—	—	—	—	—	—	38
—	—	—	—	VS	VS	—	—	—	VS	—	—	—	—	—	—	—	—	39
Solubility in vinyl chloride–vinyl acetate co-polymer 0·5%									—	—	—	—	—	—	—	—	—	40
—	S	—	—	—	VSS	—	—	—	—	—	—	—	S	—	—	—	—	41
SS	—	—	—	VS	VS	—	—	VS	—	—	—	—	—	—	—	—	—	42
SS	Insol	—	Insol	S	VS	S	Insol	—	—	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	43
2	—	SS	—	—	6	SS	—	—	—	—	—	—	SS	—	—	Insol	SS	44
20	—	1	—	10	<1	1·5	—	—	—	—	—	—	<1	—	—	Insol	<1	45
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	46
																		47
9	Insol	—	—	9	8	Insol	—	—	—	—	—	—	Insol	—	—	Insol	—	48
—	—	VSS	—	—	7	<0·1	—	9	10	—	—	—	VSS	—	—	—	VSS	49
—	—	3	—	—	10	5	—	10	10	—	—	—	1	—	—	—	0·1	50
—	—	—	—	—	*Benzyl alcohol* 50	—	—	—	—	—	—	—	—	—	—	—	—	51
VS	SS	—	—	VS	S	SS	—	—	—	—	—	—	SS	—	—	—	SS	52

C.I. Solvent Blue	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
53	—	Monoazo	Navy	Good (NC inks)	—	—	—	—	—	Alcoholic and ester solvents. Printing inks, NC and vinyl lacquers. Mass coloration of cellulose acetate
54	—	Triarylmethane	Bright Reddish Blue	Poor (oleic acid)	—	—	Insol	Insol	Good	Ball point inks
55	—	Phthalocyanine	Greenish Blue	Good (NC lacquer)	—	200	Insol	V. good	Fair (greener)	Alcoholic and ester solvents. Transparent air-drying, stoving or acid hardening lacquers based on NC or spirit soluble resins, plastics. Anodised aluminium, wood stains
56	—	—	Dull Reddish Blue→Navy Blue	—	—	Good fastness	Insol	—	—	Alcoholic solvents. Clean handling hectographic inks
57	—	—	—	—	—	—	Insol	—	—	Alcoholic solvents. Clean handling hectographic inks
58	—	Anthraquinone	—	Good (polystyrene)	—	260 (polystyrene)	Insol	—	—	Hydrocarbon solvents, oils, fats and waxes Petroleum products and polystyrene
59	—	Anthraquinone	Bright Reddish Blue	Good (polystyrene)	—	260 (polystyrene)	Insol	—	—	Hydrocarbon solvents, oils, fats and waxes Petroleum products, polystyrene and lacquers
60	—	Indonaphthol	Reddish Blue	Good (polystyrene)	—	260 (polystyrene) 125 (petroleum products)	Insol	Unalt	—	Hydrocarbon solvents, oils, fats and waxes Petroleum products, motor oil, waxes, stains and plastics
61	—	—	Reddish Blue	—	—	—	—	—	—	Hydrocarbon solvents, oils, fats and waxes
62	This C.I. Generic Name is discontinued									
63	61520	Anthraquinone	Blue	Good (NC lacquer)	ca.118	—	Insol	Insol	Insol	Hydrocarbon solvents, oils, fats and waxes, plastics, grease, lubricating oil and petrol
64	—	Phthalocyanine	Greenish Blue	V. good (spirit lacquer)	—	230	Insol	Insol	Insol	Ball point inks
65	—	Anthraquinone	Blue	7 (acrylics, polystyrene)	—	280 (15 min)	Insol	—	—	Acrylics, polystyrene and polypropylene; also NC and stoving lacquers Especially in transparent media
66	—	Triphenylmethane	Bright Blue	—	—	—	—	—	—	Printing inks, carbon papers, typewriter ribbons, ball point inks
67	—	Phthalocyanine	Greenish Blue	V. good	—	180–200	Insol	Insol	Insol	NC and vinyl lacquers, stoving enamels, printing and ball point inks, polystyrene, cellulosic derivatives

SOLUBILITY IN																		C.I. Solvent Blue
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
—	S	—	—	VS	VS	VS	—	VS	—	—	—	—	S	—	—	—	S	53
—	—	—	—	—	*Benzyl alcohol* 40	—	—	—	—	—	30	—	—	—	20	—	—	54
6	10	5	—	10	10	3	Insol	2	—	Insol	SS	Insol	8	VSS	S	Insol	0·5	55
—	—	—	—	—	VS	—	—	—	—	—	—	—	—	—	—	—	—	56
—	—	—	—	—	VS	—	—	—	—	—	—	—	—	—	—	—	—	57
S	S	—	—	SS	S	S	—	—	—	S	S	SS	VS	S	S	—	S	58
S	S	—	—	S	SS	S	SS	—	—	—	S	SS	S	S	S	—	S	59
SS	S	—	—	—	SS	S	SS	—	—	—	—	SS	S	SS	—	—	S	60
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	61
																		62
0·5	0·6	0·4		—	—	0·05	—	0·25	—	—	—	—	0·5	0·6	0·05	—	—	—	63
Insol	Insol	—	—	—	Insol (*Benzyl alcohol* VS)	Insol	—	—	—	—	SS	—	—	—	SS	—	—	64
S	—	—	—	—	SS	S	—	—	—	—	—	—	VS	—	—	S	—	65
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	66
VS	SS	—	—	VS	VS	S	Insol	—	—	Insol	Insol	Insol	SS	Insol	Insol	—	SS	67

C.I. Solvent Blue	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
68	**61110**	Anthraquinone	Reddish Blue	6 (cellulose acetate)	—	—	—	—	—	Cellulose acetate; also polystyrene and other thermoplastics Textiles: C.I. Disperse Blue 19
69	**62500**	Anthraquinone	Greenish Blue	5 (cellulose acetate)	—	—	—	—	—	Cellulose acetate; also polystyrene and other thermoplastics Textiles: C.I. Disperse Blue 7
70	—	Phthalocyanine	Bright Greenish Blue	Good (NC lacquer)	—	150	V. good	Good	Good	Alcoholic and ester solvents. Transparent resin lacquers, wood stains, plastics
71	—	Triphenylmethane	Blue	Poor	—	—	Insol	—	—	Oils, fats and waxes Typewriter ribbons, carbon paper, ball point and stamping pad inks
72	—	Triphenylmethane	Reddish Blue	Poor	—	—	Insol	—	—	Typewriter ribbons, carbon papers, ball point inks (including glycol based), rotary printing inks
73	—	Triphenyl methane	Blue (Methanol)	—	—	—	—	—	—	Alcoholic solvents
74	***63005***	Anthraquinone	Blue	—	—	—	—	—	—	
75	—	Phthalocyanine	Blue	6–7 (glycol ink)	—	—	S	—	—	Glycol (moisture set) printing inks, flexographic inks, ball point, stamp pad, felt pen and writing inks. Paper dyeing (dye has high substantivity for cellulose). Soap
76	**67405:1**	Anthraquinone	Blue	V. good (spirit lacquer)	218–220	150 sublimes at 200	Insol	Unalt	Unalt	Ester and hydrocarbon solvents, oils, fats and waxes. In liquid fuels
77				This C.I. Generic Name is discontinued						
78	***61500*** similar	Anthraquinone	Blue	6	—	—	—	Unalt	—	In mineral oil products
79	—	Anthraquinone	Reddish Blue	—	—	—	—	—	—	Hydrocarbon solvents Liquid hydrocarbon fuels
80	—	Anthraquinone	Blue	6 (polystyrene)	—	300 (10 min)	—	—	—	Polystyrene and polyamides
81	—	Triarylmethane	Greenish Blue	—	—	—	—	—	—	Brightening rotary printing inks containing carbon black; also typewriter ribbons
82	—	Anthraquinone	Blue	Excellent (polystyrene)	—	280 (polystyrene)	Insol	Unalt	V. good	Thermoplastic resins

SOLUBILITY IN																	C.I. Solvent Blue
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
S	—	—	SS	—	SS	—	(*Pyridine:* S)			—	—	—	Insol	—	—	SS	—	68
S	—	—	—	—	SS	—	(*Pyridine:* S)			—	—	—	Insol	—	—	Insol	—	69
6	—	30	—	12	12	3	—	—	12	—	—	—	Insol	—	—	—	Insol	70
—	VS	—	—	SS	S	S	SS	—	—	Insol	VS	Insol	VS	—	VS	Insol	VS	71
—	VS	—	—	SS	S	S	SS	—	—	Insol	VS	Insol	VS	—	VS	Insol	VS	72
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	73
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	74
Miscible in all proportions with benzyl alcohol, ethanol and methylglycol																		75
S	S	—	S	VSS	SS	SS	S	—	—	SS	S	S	S	SS	S	SS	S	76
																		77
0·5	1·0	0·5	—	—	0·2	—	—	—	—	—	—	0·5	1·0	2	3·5	1·0	1·0	78
Miscible with alcohols, aromatics, mineral oils, white spirit and other hydrocarbons																		79
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	80
10	—	—	—	—	60	—	—	—	—	—	—	—	—	—	—	—	—	81
2·2	—	—	—	1·5	0·6	1·8	—	—	—	—	—	—	0·4	—	—	—	—	82

C.I. Solvent Blue 83—87

C.I. Solvent Blue	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
83	—	Anthraquinone	Reddish Blue	V. good (polystyrene)	—	280 (polystyrene)	Insol	Unalt	Unalt	Thermoplastic resins
84	—	Anthraquinone	Blue	Excellent (polystyrene)	—	280 (polystyrene)	Insol	Unalt	Unalt	Thermoplastic resins
85	—	Anthraquinone	Blue	V. good (polystyrene)	—	280 (polystyrene)	Insol	Unalt	Good	Thermoplastic resins
86	—	Anthraquinone	Reddish Blue	Good (polystyrene)	—	280 (polystyrene)	Insol	Unalt	Unalt	Thermoplastic resins
87	—	Anthraquinone	Blue	V. good (polystyrene)	—	280 (polystyrene)	Insol	Unalt	Unalt	Thermoplastic resins

SOLUBILITY IN																		C.I. Solvent Blue
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
0·3	—	—	—	0·2	0·03	0·6	—	—	—	—	—	—	1·8	—	—	—	—	**83**
1·2	—	—	—	1·4	0·3	1·1	—	—	—	—	—	—	2·8	—	—	—	—	**84**
0·2	—	—	—	0·1	0·02	0·1	—	—	—	—	—	—	0·2	—	—	—	—	**85**
2·0	—	—	—	3·5	0·3	1·7	—	—	—	—	—	—	0·9	—	—	—	—	**86**
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**87**

C.I. Solvent Green 1—12

C.I. Solvent Green	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
1	42000:1	Triaryl-methane	Bright Bluish Green	Poor (wax)	—	60 (oleic acid) sublimes	—	Tends to decolourise	—	Dissolved in fatty acid for carbon papers, typewriter ribbons, ball point and rotogravure printing inks. Also dissolved in acetic acid for use in ethanol
2	—	Triaryl-methane	Bluish Green (NC lacquer)	—	—	—	—	—	—	Lacquers and plastics
3	61565	Anthra-quinone	Bluish Green	Good	155	V. good stability, some sublimation above 100	Insol	Unalt	Unalt	Hydrocarbon solvents, oils, fats and waxes Petrol, naphtha wood stains, soap. Cellulose acetate and polystyrene. In oleic or stearic acid for rotogravure inks
4	45550	Xanthene	Dull Olive (Mineral oil)	F. good	—	—	Insol	—	—	Hydrocarbon solvents, oils, fats and waxes. Fluorescent effects in mineral oils
5	59075	Anthra-quinone	Dull Olive (Petroleum ether)	—	—	—	—	—	—	Hydrocarbon solvents. Fluorescent colouration of petroleum ether
6	59845	Anthra-quinone	Dull Olive (Mineral oil)	Fair	—	—	Insol	—	—	Hydrocarbon solvents, oils, fats and waxes. Fluorescent colouration of mineral oils
7	59040	Anthra-quinone	Yellowish Green	—	—	—	S	—	—	Drugs and cosmetics. Textiles: C.I. Acid Green 9
8	—	Acid/Basic dyestuff complex	Bright Green	V. good (spirit varnish)	190–198	150 (spirit varnish) does not sublime	Good	Becomes bluish green	Poor	Alcoholic solvents for varnishes and lacquers
9	—	Acid/Basic dyestuff complex	Bright Yellowish Green	V. good (spirit varnish)	142–150	>150 (spirit varnish) does not sublime	Good	Becomes reddish brown	Good	Alcoholic solvents for varnishes and lacquers
10	—	—	Yellowish Green	Poor	—	190–225	SS	—	—	Alcoholic and other lacquer solvents. Spirit and non-grain raising wood stains, shellac products, metal foil lacquers. Plastics
11	—	—	Bright Green	Poor	—	195–225	—	—	—	Alcoholic and other lacquer solvents. Spirit and non-grain raising wood stains, shellac products, metal foil lacquers. Plastics
12	—	—	Yellowish Green	F. good	—	120 (resin) some sublimation above 100	Insol	Good	V. good	Oils, fats, waxes and hydrocarbon solvents

SOLUBILITY IN																	C.I. Solvent Green
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
0·1	—	Insol	—	—	0·4	SS	Insol	—	—	Insol	30	0·2	0·1	—	30	Insol	—	1
SS	Insol	—	—	S	S	SS	Insol	S	—	—	—	—	Insol	Insol	—	—	—	2
SS	S	—	—	—	VSS	SS	SS	—	—	SS	SS	VSS	S	SS	SS	SS	—	3
—	S	—	—	—	—	—	—	—	—	S	—	—	S	—	—	S	S	4
—	—	—	—	—	—	—	—	—	—	S	—	—	—	—	—	—	—	5
—	S	—	—	—	—	—	—	—	—	S	—	—	S	—	—	S	S	6
VSS	Insol	VSS	—	—	SS	—	—	—	—	Insol	VSS	Insol	—	—	VSS	—	—	7
S	Insol	Insol	—	S	S	Insol	SS	S	—	Insol	Insol	Insol	Insol	—	Insol	Insol	Insol	8
S	Insol	Insol	—	S	S	SS	SS	S	—	Insol	Insol	Insol	Insol	—	Insol	Insol	Insol	9
SS	Insol	—	—	VS	VS	Insol	—	VS	—	—	—	—	—	—	—	—	—	10
—	—	—	—	VS	VS	—	—	VS	—	—	—	—	—	—	—	—	—	11
—	4	—	—	—	—	—	—	—	—	—	2	1	—	—	2	—	—	12

C.I. Solvent Green	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
13	*10445 51005*	Acid/ Basic dyestuff complex	Green	Good	—	—	S (1·5%)	—	—	Alcoholic solvents Spirit lacquers for metal foils and wood. Light fast wood stains Literature: *FIAT* 1331, **3**, 133
14	—	—	Green	V. good	—	—	SS	—	—	Alcoholic solvents Spirit lacquers for metal foils and wood. Light fast wood stains
15	42055	Triaryl-methane	Bright Green	Good	—	180 (P/F plastics) does not sublime	VS	V. good	V. good	Synthetic resins of the P/F type Textiles: C.I. Acid Green 7
16	—	Metal complex	Olive	V. good	—	180	—	—	—	Alcoholic and ester solvents. Transparent NC and cellulose lacquers, polyester and polyvinyl plastics
17	—	Azo	Bright Yellowish Green	Good	—	—	Good	—	—	Urea-formaldehyde and similar stoving lacquers. Moderately fast to overspraying in NC lacquer
18	—	Azo	Green	Fair	—	—	Good	—	—	Urea-formaldehyde and similar stoving lacquers. Good fastness to overspraying on NC lacquer
19	—	Anthra-quinone	Dull Bluish Green	V. good (lacquer) 7–8 (ECE) (acetate)	—	175	Insol	—	—	Mass colouration (spin dyeing) of acetate fibre. Transparent stoving enamels
20	—	Anthra-quinone	Green	7 (poly-methacrylate and poly-styrene) 6 (poly-propylene)	—	240 (15 min)	Insol	—	—	Generally in acrylic, polystyrene and NC lacquers but poor solubility in lacquer solvents Good UV and IR absorption in anti-glare screens. Cellulose aetate products
21	—	Azo (Metal complex)	Yellowish Green	4 (40%)	—	120 (1 hr) 70 (2 hr)	—	—	—	Transparent varnishes and printing inks
22	—	Phthalo-cyanine	Green	—	—	—	—	—	—	Especially for non-fading ball point inks
23	—	Anthra-quinone	Bluish Green	—	—	300 (20 min)	—	—	—	Polystyrene and polyamides
24	—	Anthra-quinone	Bluish Green	Excellent (poly-styrene)	—	280 (polystyrene)	Insol	Unalt	Unalt	Thermoplastic resins
25	—	Anthra-quinone	Yellowish Green	Excellent (poly-styrene)	—	280 (polystyrene)	Insol	—	Unalt	Thermoplastic resins

SOLUBILITY IN																		C.I. Solvent Green
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
1·6	Insol	SS	—	—	5·5	Insol	—	3	—	—	—	—	Insol	—	—	Insol	Insol	13
0·5	SS	Insol	—	—	4	SS	—	3	—	—	—	—	SS	—	—	Insol	SS	14
VSS	Insol	Insol	—	—	S	Insol	SS	—	—	Insol	SS	Insol	Insol	—	SS	Insol	Insol	15
S	—	—	—	—	S	S	—	—	—	—	—	—	—	—	—	—	—	16
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	17
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	18
1	—	1	—	3	<1	1	—	—	—	—	—	—	<1	—	—	Insol	<1	19
<0·5	—	—	—	—	<0·1	<0·5	—	—	—	—	—	—	1–5%	—	—	<0·5	—	20
1	Insol	0·2	—	—	0·3	—	—	0·8	10	—	—	—	Insol	—	—	—	—	21
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	22
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	23
0·1	—	—	—	0·1	0·2	0·2	—	—	—	—	—	—	0·9	—	—	—	—	24
0·07	—	—	—	0·02	0·004	0·09	—	—	—	—	—	—	0·46	—	—	—	—	25

C.I. Solvent Brown	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
1	11285	Monoazo	Reddish Orange→ Brown (Lithographic varnish)	Fair (litho-graphic varnish)	155–160	>150 (spirit varnish)	Insol	Unalt	V. good	Alcoholic solvents, oils, fats and waxes. Double tone and photogravure printing inks, spirit lacquers and polishing waxes
2	11330	Monoazo	Dull Orange→ Brown	Poor	—	—	Insol	Good (becomes reddish)	Good	Oils, fats and wax products. Spirit lacquers and double tone and photogravure printing inks
3	11360	Monoazo	Dull Reddish Orange→ Brown	Poor	140–152	100 sublimes above 100	Insol	Unalt	Becomes violet	Alcoholic, ester and hydrocarbon solvents, oils, fats and waxes. Wax products and cellulose and synthetic resin lacquers
4	12000	Monoazo (may contain some disazo dye)	Dull Reddish Brown	Fair (oil)	182	90 slight sublimation above 90	Insol	V. good	Insol	Ester and hydrocarbon solvents, oils, fats and waxes. Mainly in wax polishes
5	12020	Monoazo	Dull Brown (NC lacquer)	Poor (good in mineral oil)	170	100 (stearic acid, paraffin) sublimes above 100	Insol	Good	V. good	Alcoholic, ester and hydrocarbon solvents, oils, fats and waxes. Cellulose and synthetic resin lacquers
6	—	Acid/Basic dyestuff complex	Yellowish Brown→ Brown (Spirit varnish)	Excellent (spirit varnish)	220–230	150 (spirit varnish) does not sublime	V. good	Poor (becomes greener)	Reddens	Alcoholic solvents Alcoholic varnishes and various lacquers
7	—	Monoazo	Dull Orange→ Brown (Mineral oil)	Good (mineral oil)	102–104	70 (oil varnish) sublimes above 195	Insol	Unalt	Unalt	Alcoholic, ester and hydrocarbon solvents, oils, fats and waxes. Very highly soluble in beeswax. Polishes, varnishes and lacquers
8	—	Monoazo	Yellowish Brown (Cellulose acetate)	Fair (NC lacquer)	—	160 (alkyd resin lacquer) 30 min	Poor	—	—	Alcoholic, ester and ketonic solvents. NC lacquer (metal foils), paper printing, alkyd and vinyl resin lacquers, cellulose acetate moulding powders
9	—	Monoazo	Reddish Brown	Poor (spirit lacquer)	143·5–151	120 (alkyd resin lacquer) sublimes above 100	Insol	Unalt	Unalt	Oils, fats and waxes Turpentine creams, P/F moulding powders, wood stains
10	—	Monoazo	Bright Reddish Brown	Poor (spirit lacquer)	143–155	175 (polystyrene) 120 (alkyd resin lacquer)	Insol	Good	Good (trace redder)	Oils, fats and waxes and hydrocarbon solvents Polishes and floor stains. P/F moulding powders and polystyrene plastics
11	—	Azo	Reddish Brown	—	—	—	—	—	—	Polishes and other wax products, intaglio inks, oil stains, lacquers, varnishes, resins and plastic (especially polystyrene)

SOLUBILITY IN																	C.I. Solvent Brown
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
S	SS	—	—	—	S	SS	SS	—	—	SS	S	SS	SS	—	S	SS	SS	1
VS	VS	VS	—	—	S	VS	S	—	—	S	VS	S	VS	—	VS	S	VS	2
1·5	1·5–2	2–6	—	—	0·5–0·75	2	2–4·5	—	—	0·16–0·5	1·9–4·5	0·38–1·5	1·5	—	1·5–4	0·075–0·3	1·5	3
0·5	SS	0·8	—	—	0·4	1·3	1·5	—	—	SS	1·4	SS	SS	—	SS	SS	0·3	4
0·9–3	0·12–0·3	1·5–2·5	—	—	0·19–1	1·5–2	0·38–1	—	—	0·2	0·66–1	0·19–1·2	0·5–1	—	0·38–2	0·04–0·1	0·16–0·8	5
Insol	Insol	Insol	—	S	S	Insol	SS	S	—	Insol	Insol	Insol	Insol	—	SS	Insol	Insol	6
S	S	S	—	—	SS	S	S	—	—	S	S	S	S	—	S	S	S	7
>10	—	>10	—	—	>10	—	—	—	>10	—	—	—	VSS	—	—	VSS	—	8
0·4	0·5	1·0	—	—	0·1	—	0·6	—	—	0·1	0·1	VSS	0·8	—	1·0	VSS	0·6	9
3	5	4	—	—	1·8	—	12·5	—	—	0·3	2	0·3	3·2	—	3	0·4	0·2	10
SS	SS	—	SS	S	SS	SS	S	SS	—	S	—	S	SS	SS	S	SS	SS	11

C.I. Solvent Brown	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
12	21010:1	Disazo	Dull Yellowish Red→Brown (Spirit varnish)	Fair (spirit varnish)	130–135	>150 (spirit varnish)	V. good	Unalt	Poor	In fatty acids, abietic acid and acetic acid. Fats, waxes, varnishes and wood stains
13	—	Tetra-kisazo	Dull Red→ Reddish Brown (Mineral oil)	Good (mineral oil)	108	70 (oil varnish) sublimes above 250	Insol	Unalt	Unalt	Ester and hydrocarbon solvents, oils, fats and waxes. Varnishes, lacquers, polishes
14	—	Trisazo	—	—	—	—	—	—	—	Oils, fats, waxes
15	—	—	Dull Yellowish Red	—	—	—	—	—	—	Thermoplastic resins
16	—	—	Dull Yellowish Red	—	—	—	—	—	—	Thermoplastic resins
17	—	—	Brown	Poor	—	175–205	—	—	—	Metal foil lacquers, plastics, non-grain raising wood stains
18	—	—	Reddish Brown	Good	—	120 (resin) some sublimation above 80	Insol	Good	Good	Alcohol, ester and hydrocarbon solvents, oils, fats and waxes. Spirit varnishes, lithographic inks
19	—	—	Brown	Poor–fair	—	175–205	—	—	—	Bright metal foil lacquers, plastics, non-grain raising wood stains
20	—	—	Brown	Poor	—	175–205	—	—	—	Lacquers
21	—	—	Brown	—	—	—	—	—	—	Shoe polishes, wood stains
22	—	—	Bordeaux	—	—	—	—	—	—	Oils and polystyrene
23	—	Metal complex	Reddish Brown	V. good	—	180	—	—	—	Alcoholic and ester solvents. Transparent NC and cellulose ester lacquers; polyester and polyvinyl plastics
24	—	Metal complex	Yellowish Brown	V. good	—	180	—	—	—	Alcoholic and ester solvents. Transparent NC and cellulose ester lacquers; polyester and polyvinyl plastics
25	—	Metal complex	Yellowish Brown	V. good	—	180	—	—	—	Alcoholic and ester solvents. Transparent NC and cellulose ester lacquers; polyester and polyvinyl plastics
26	—	Azo	Reddish Brown	Good	—	—	Good	—	—	Urea-formaldehyde and similar stoving lacquers. Fastness to overspraying NC lacquer good
27	—	Azo	Brown	V. good	—	—	Good	—	—	Urea-formaldehyde and similar stoving lacquers. Fastness to overspraying NC lacquer good

SOLUBILITY IN																	C.I. Solvent Brown
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
S	SS	—	—	—	S	SS	SS	—	—	Insol	VS	SS	SS	S	VS	Insol	—	12
S	S	S	—	—	SS	S	S	—	—	SS	VS	SS	S	—	S	SS	S	13
S	—	—	—	—	—	S	S	—	—	S	S	—	—	—	—	—	—	14
VS	VS	—	—	—	S	S	SS	—	—	SS	S	SS	VS	SS	S	—	—	15
VS	S	—	—	—	S	VS	SS	—	—	—	SS	SS	S	SS	SS	—	—	16
SS	—	—	—	VS	VS	—	—	VS	—	—	—	—	—	—	—	—	—	17
10	5	15	—	—	2	—	2	—	—	0·2	3	—	—	—	3	0·5	—	18
SS	—	—	—	VS	VS	—	—	VS	—	—	—	—	—	—	—	—	—	19
SS	—	—	—	VS	VS	—	—	VS	—	—	—	—	—	—	—	—	—	20
S	VS	—	—	—	SS	S	S	—	—	SS	S	SS	VS	VS	S	—	—	21
—	VS	—	—	—	—	S	S	—	—	S	S	S	VS	S	S	—	—	22
S	—	—	—	—	S	S	—	—	—	—	—	—	—	—	—	—	—	23
S	—	—	—	—	S	S	—	—	—	—	—	—	—	—	—	—	—	24
S	—	—	—	—	S	S	—	—	—	—	—	—	—	—	—	—	—	25
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	26
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	27

C.I. Solvent Brown 28—44

C.I. Solvent Brown	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
28	—	Azo (Metallised)	Dull Brown	V. good (lacquer) 8 (cellulose acetate)	—	175	Insol	—	—	Mass colouration (spin dyeing) of acetate fibre. Fastness to gas fumes: 5 Transparent stoving and foil lacquers
29	—	Azo (Metallised)	Reddish Brown	V. good (lacquer) 8 (cellulose acetate)	—	175	Insol	—	—	Mass colouration (spin dyeing) of acetate fibre. Fastness to gas fumes: 5 Transparent stoving and foil lacquers
30	This C.I. Generic Name is discontinued									
31	—	Azo (Metallised)	Dull Brown	8 (cellulose acetate)	—	—	—	—	—	Mass colouration (spin dyeing) of acetate fibre. Fastness to gas fumes: 3–4
32	—	—	These C.I. Generic Names are discontinued							
33										
34	—	Monoazo	Brown	V. good (NC ink)	—	—	—	—	—	Mass colouration of cellulose acetate; NC based printing inks
35	—	Monoazo	Reddish Brown	Good (NC printing inks)	—	—	—	—	—	Alcohol and ester solvents. NC and vinyl lacquers. Mass colouration of cellulose acetate
36	—	Monoazo	Olive→ Dark Brown	V. good (NC printing inks)	—	—	—	—	—	Mass colouration of cellulose acetate. NC based printing inks
37	—	Monoazo (Metal complex)	Reddish Brown	V. good	—	200 (stoving lacquer)	Fair	V. good	V. good	Alcoholic and ester solvents. Transparent air-drying, stoving or acid hardening lacquers based on NC or spirit-soluble natural or synthetic resins
38	—	Azo	Brownish Grey→ Brown	F. good (NC lacquer)	—	—	VSS	—	—	Alcoholic solvents. Lacquer stains and spirit lacquers
39	40291	Stilbene	—	—	—	—	—	—	—	Alcoholic solvents
40	—	Azo	Brown	3 (ball point ink)	—	—	SS	—	—	Mainly ball point inks. Also wood stains, some lacquers, printing inks and plastics. Very soluble in propylene glycol
41	21000:1	Disazo	Yellowish Brown	—	—	—	—	—	—	Similar to C.I. Solvent Brown 12
42	—	Azo (Metal complex)	Yellowish Brown	6–7	—	160 (20 min)	—	—	—	Transparent varnishes and printing inks especially for metal foils
43	—	Azo (Metal complex)	Brown	7	—	160 (20 min)	—	—	—	Transparent varnishes and printing inks, especially for metal foils
44	—	Azo (Metal complex)	Reddish Brown	7	—	70 (2 hr)	—	—	—	Transparent varnishes and printing inks, especially for metal foils

SOLUBILITY IN																		C.I. Solvent Brown
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
6	—	<1	—	3	6	<1	—	—	—	—	—	—	Insol	—	—	Insol	Insol	28
<1	—	SS	—	8	<1	SS	—	—	—	—	—	—	Insol	—	—	Insol	Insol	29
																		30
VS	Insol	—	—	VS	VS	S	—	—	—	—	—	—	Insol	—	—	—	Insol	31
																		32
																		33
VS	Insol	—	—	VS	VS	S	—	—	—	—	—	—	—	—	—	—	Insol	34
VS	Insol	—	—	VS	VS	VS	—	—	—	—	—	—	Insol	—	—	—	Insol	35
VS	Insol	—	—	VS	VS	S	—	—	—	—	—	—	Insol	—	—	—	Insol	36
0·5	Insol	1	—	10	1	1	—	2·5	—	—	—	—	—	—	—	—	—	37
SS	—	—	—	S	S	SS	—	—	—	—	—	—	—	—	—	—	—	38
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	39
SS	—	—	—	—	S	VSS	—	—	—	—	—	—	Insol	—	—	Insol	—	40
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	41
1·5	Insol	0·2	—	—	3	0·2	—	2	8	—	—	—	Insol	—	—	—	—	42
3	Insol	0·4	—	—	8	0·5	—	2	13	—	—	—	Insol	—	—	—	—	43
60	0·2	7·5	—	—	10	12	—	10	—	—	—	—	0·2	—	—	—	—	44

C.I. Solvent Black	C.I. Constitution Number	Chemical Class	Hue	FASTNESS					USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
1	—	Monoazo	Bluish Black (Cellulose acetate)	Good (NC lacquer)	—	120 (alkyd resin lacquer) does not sublime	Insol	—	—	Alcoholic, ester and ketonic solvents. NC, alkyd resin and vinyl resin lacquers; celluloid and cellulose acetate moulding powders; polymethacrylic resins and polystyrene
2	—	Monoazo	Brownish Black	Good (NC lacquer)	—	120 (alkyd resin lacquer) does not sublime	Insol	—	—	Alcoholic, ester and ketonic solvents. NC, alkyd resin and vinyl resin lacquers; cellulose acetate moulding powders and polymethacrylic resins (for extrusion)
3	26150	Disazo	Bluish Black (Lithographic varnish)	Fair (Lithographic varnish)	126	100 (oil varnish) does not sublime	Insol	Unalt	Unalt	Alcoholic, ester and hydrocarbon solvents. Printing inks and cellulose lacquers; also oils, fats and waxes
4	26040	Disazo	Reddish Black	Good (waxes)	—	—	Insol	—	—	Ester solvents, oils, fats and waxes
5	50415	Azine	Bluish Black (Spirit varnish)	Good (spirit varnish)	—	150 (spirit varnish) ignites at high temperature	Insol	V. good	Unalt	Alcoholic solvents. Spirit varnishes and lacquers (especially shellac), spirit wood stains; 'Aniline Black' marking inks; spirit finishes for leather; printing inks for rubber stereos; also P/F moulding powders and U/F stoving lacquers
6	—	Monoazo	Greenish Black	Good (NC lacquer)	—	120 (alkyd resin lacquer) does not sublime	Insol	—	—	Alcoholic, ester and ketonic solvents. NC, alkyd resin and vinyl resin lacquers, cellulose acetate moulding powders; mass colouration of cellulose acetate
7	50415:1	Azine	Black (Fatty acid) Bluish Black (NC lacquer)	Fair–good As rosinate V. good	>180	180 does not sublime	Insol	V. good	V. good	Usually dissolved in a fatty acid, especially oleic or stearic acid to form the oleate or stearate Widely used in shoe polishes. In oils, fats and waxes; typewriter ribbons, carbon papers, stamping inks; P/F moulding powders; as rosinate in NC lacquers; stearate and oleate in rotogravure inks, solvent inks. Also leather dyes and finishes and occasionally printing inks
8	—	Acid/Basic dyestuff complex	Bluish Black (Spirit varnish)	Excellent (spirit varnish and cellulose lacquer)	135–142	>150 (spirit varnish) does not sublime	V. good	Unalt	Unalt	Alcoholic solvents. Alcoholic varnishes and various lacquers

SOLUBILITY IN																		C.I. Solvent Black
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
4	—	0·5	—	—	1·5	—	—	—	1	—	—	—	Insol	—	—	Insol	—	1
3	—	2	—	—	3	—	—	—	7	—	—	—	VSS	—	—	VSS	—	2
S	S	S	S	—	S	S	S	—	—	S	S	S	S	S	S	S	S	3
0·6	0·5	2	—	—	0·5	1	1·5	—	—	0·6	4	1	0·5	—	6	0·05	—	4
0·4—1·5	VSS	0·6	—	—	1·5–7	VSS	Insol	S	—	Insol	Insol	Insol	Insol	Insol	Insol	Insol	VSS	5
2	—	2	—	—	1·5	9	—	—	—	—	—	—	Insol	—	—	Insol	—	6
0·2	SS	VSS	—	SS	0·2—0·4	VSS	—	—	—	Insol	33	VSS	SS	SS	33	VSS	SS	7
S	Insol	S	—	S	S	S	SS	S	S	Insol	Insol	Insol	Insol	—	Insol	Insol	Insol	8

C.I. Solvent Black	C.I. Constitution Number	Chemical Class	Hue	FASTNESS						USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
9	—	—	Reddish Black	Fair	110	—	Insol	Unalt	Good	Alcohol, ester and hydrocarbon solvents, oils, fats and waxes. Shoe creams, cellulose and synthetic resin lacquers
10	—	—	Black	Fair	50	—	Insol	Unalt	Insol (becomes somewhat redder)	Oils, fats and waxes. Shoe creams and polishing waxes
11	—	—	Black	Fair (paraffin)	50	—	Insol	Insol	Insol	Oils, fats and waxes. Shoe creams and polishing waxes
12	—	—	Black	—	—	—	—	—	—	Hydrocarbon solvents, oils, fats and waxes—purplish black hues
13	—	—	Bluish Black (Lacquer)	—	—	—	—	—	—	Lacquers
14	—	—	Bluish Black	—	—	—	—	—	—	Spirit wood stains
15	—	Monoazo	Bluish Black (Cellulose acetate)	Good (NC lacquer)	—	120 (alkyd resin lacquer) does not sublime	Insol	—	—	Alcoholic, ester and ketonic solvents. NC, alkyd resin and vinyl resin lacquers, cellulose acetate moulding powders; mass colouration of cellulose acetate
16	—	—	Reddish Black	Poor	—	—	—	—	—	Oils and polystyrene
17	—	—	Black	Poor	—	195–225	—	—	—	Lacquers
18	—	—	Black	V. good	—	180 (resin) does not sublime	Insol	Unalt	Unalt	Alcoholic solvents. Spirit and cellulose ester varnishes
19	—	—	Black	—	—	—	—	—	—	Lacquers, alcohol and ester soluble plastics, fast to light wood stains
20	—	—	Bluish Black	—	—	—	—	—	—	Mainly in ball point inks
21	—	—	Blue→Black	V. good	—	180	Insol	—	—	Transparent NC and cellulose ester lacquers and in polyester and polyvinyl plastics
22	—	Azo (Metallised)	Black	—	—	—	—	—	—	In alcoholic solvents
23	—	Azo (Metallised)	Black	—	—	—	—	—	—	In alcoholic solvents
24	—	Monoazo	Black	Excellent (ball point ink)	—	—	—	—	—	Glycol and alcoholic solvents. Ball point inks. Vinyl and NC coatings on aluminium foil
25	—	Azo (1:2 metal complex)	Reddish Grey→ Black	V. good	—	180	Insol	—	—	Alcohol and ester solvents. Transparent NC and cellulose ester lacquers and polyester and polyvinyl plastics

SOLUBILITY IN																	C.I. Solvent Black
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
0·6	1·6	1·5	—	—	0·3	S	0·34	—	—	0·24	0·76	0·38	S	—	0·76	0·12	0·28	9
SS	VS	SS	—	—	SS	SS	—	—	—	S	S	S	VS	—	VS	S	VS	10
VS	VS	S	—	—	S	S	S	—	—	S	S	S	VS	—	VS	S	VS	11
S	VS	—	S	—	SS	S	S	—	—	SS	S	SS	VS	S	S	—	—	12
VS	VS	—	SS	—	VS	VS	S	—	—	VSS	S	SS	VS	S	S	—	—	13
SS	Insol	—	—	VS	VS	VSS	—	VS	—	—	—	—	—	—	—	—	—	14
4	—	4·5	—	—	0·5	7	—	—	—	—	—	—	Trace	—	—	Insol	—	15
—	S	—	—	—	SS	—	—	—	—	—	S	—	S	—	S	—	—	16
—	—	—	—	VS	VS	—	—	VS	—	—	—	—	—	—	—	—	—	17
—	—	—	—	—	10	—	—	—	—	—	—	—	—	—	—	—	—	18
SS	—	—	—	VS	VS	SS	—	VS	—	—	—	—	—	—	—	SS	—	19
—	—	—	—	VS	VS	—	—	—	VS	—	—	—	—	—	—	—	—	20
S	—	—	—	—	S	S	—	—	—	—	—	—	—	—	—	—	—	21
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	22
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	23
Insol	Insol	—	Insol	VS	S	SS	Insol	—	—	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	24
S	—	—	—	—	S	S	—	—	—	—	—	—	—	—	—	—	—	25

C.I. Solvent Black 26—35

C.I. Solvent Black	C.I. Constitution Number	Chemical Class	Hue	FASTNESS					USAGE
				Light	Heat		Water	Na_2CO_3 5%	HCl 5%	
					m.p. °C	Stable to °C				
26	—	Azo	Bluish Grey	F. good (NC lacquer)	—	—	Insol	Unalt	—	Alcoholic solvents Spirit lacquers and stains
27	—	—	Black	V. good (NC lacquer)	—	200	V. good	Good	Good	Transparent lacquers based on alcohol or ester soluble resins; wood stains, plastics
28	—	Monoazo (Metal complex)	Black	Good (NC lacquer)	—	—	Insol	V. good	V. good	Cellulose acetate lacquer
29	—	Azo (Metal complex)	Black	5	—	140 (45 min)	—	—	—	Transparent varnishes and printing inks, especially for metal foils
30	—	Azo (Metal complex)	Olive	4	—	—	—	—	—	Transparent varnishes and printing inks, especially for metal foils
31	—	Polyazine	Black	6–7	—	230 (30 min)	—	—	—	Polystyrene and polyamides
32	—	Polyazine	Black	—	—	—	—	—	—	Polystyrene and polyamides
33	—	—	Black	7 (NC lacquer) 5 (Vinyl lacquer)	—	—	Insol	5	—	Alcoholic varnishes, cellulose and other lacquers
34	12195	Monoazo (Chromium complex)	Bluish Grey	—	—	—	—	—	—	Mass coloration of cellulose acetate
35	12195 12197	Monoazo (Chromium complex)	Black	—	—	—	—	—	—	Mass coloration of cellulose acetate

SOLUBILITY IN																		C.I. Solvent Black
Acetone	Benzene	Butyl acetate	Carbon tetra-chloride	'Cello-solve'	Ethanol	Ethyl acetate	Linseed oil	Methanol	Methyl glycol	Mineral oil	Oleic acid	Paraffin wax	Toluene	Turpen-tine	Stearic acid	White spirit	Xylene	
SS	—	—	—	S	S	—	—	—	—	—	—	—	—	—	—	—	—	26
3·5	SS	3	Insol	7–10	1	1	Insol	—	10	Insol	Insol	Insol	Insol	Insol	Insol	Insol	Insol	27
VS	Insol	—	—	VS	VS	VS	Insol	—	—	Insol	Insol	Insol	Insol	—	Insol	Insol	Insol	28
8·0	0·1	12·5	—	—	13	10·5	—	15	27·5	—	—	—	0·1	—	—	—	—	29
100	Insol	2·8	—	—	12	1·7	—	100	10	—	—	—	—	—	—	—	Insol	30
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	31
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	32
—	—	—	—	—	10	—	—	10	30	—	—	—	—	—	—	—	—	33
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	34
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	35

SULPHUR DYES

When the Supplement to the 2nd Edition of the *Colour Index* was published in 1963, the development of the group of dyes applied by method 6 had proceeded to such a stage that it was necessary to draw a more definite distinction between the six groups which had previously been described in the 2nd Edition. The designations which were then published have been retained, and the table printed below gives the designations, to help the user in establishing the group into which a particular dye falls.

The 'C.I. Solubilised Sulphur' dyes carry a different C.I. Constitution Number from the parent sulphur dye (when the manufacturing method is known) as chemically they are the thiosulphonic acid derivatives of the parent dye. The 'C.I. Leuco Sulphur' dyes, on the other hand, carry the same C.I. Constitution Number as the corresponding 'C.I. Sulphur' dye, as chemically they are only pre-reduced forms of the conventional parent dye.

Since the Supplement was published, a new class of dye has been reported, which for a variety of reasons was given the classification 'C.I. Condense Sulphur'. These dyes may be applied together with 'C.I. Solubilised Sulphur' dyes by special techniques and are described in a short preamble to this small new section on page 3705.

Dyeing Methods

For the sake of convenience the general dyeing methods are reprinted in the following paragraphs. It should be noted that the proportions of reducing agents and the dyeing temperatures suggested may vary with individual dyes and the advice of the manufacturers should be followed with regard to the detailed dyeing procedure.

Method 1

The dye is pasted with a little cold water and then dissolved by boiling for 10 minutes with the necessary amount of sodium sulphide in sufficient water to give a strong sulphide concentration without exceeding the saturation point of the dye. The dissolved dye is then added to the requisite volume of water in the dyeing vessel, together with 2·5% of anhydrous sodium carbonate if required. The material to be dyed is then entered and the temperature of the dyebath raised as necessary. Common salt (5–15 g/l) or Glauber's salt crystals (10–30 g/l) is then added, the amount depending on the depth required. This is most advantageously done in several additions made during dyeing. The material is then rinsed well, aftertreated if necessary, rinsed again and finished in the normal manner.

Standing Baths

Sulphur dyes do not exhaust completely and it is advantageous to employ a standing bath, especially for full blacks and other heavy dyeings. In these cases, after the first bath, to obtain a similar depth, the dyebath is replenished with 55–75% of the weight of dye originally used. This should be dissolved separately with the necessary amount of sodium sulphide. The exact proportions required depend on the degree of exhaustion obtained in the first bath and the process may be repeated many times. No further additions of salt are necessary after the first bath.

In the entries that follow, the average degree of exhaustion is defined as moderate, good, or very good. On a percentage basis these definitions may be regarded as under 65%, 65–75% and over 75% respectively.

Method 2*

The dye is pasted with water and this paste, together with the correct amount of reducing agent, is boiled in 25–30 times its weight of soft water. The reducing agent consists of a mixture of two parts of anhydrous sodium carbonate with one part of sodium formaldehyde sulphoxylate.

The dissolved dye is added to the dyebath, which is again boiled for a short time. The material is then entered dry and is dyed for 20 minutes at the boil. Common salt or Glauber's salt is then added in an amount depending on the depth required and dyeing is continued for a further 30–40 minutes. The material is then rinsed in the normal manner and any desired aftertreatments are made.

Method 3

This method is similar to Method 1 except that little or no sodium sulphide is required to dissolve the dye. For the actual amounts required, the manufacturers' literature should be consulted.

General Generic Name	*Solubility in Water*	*Substantivity in Water*	*Descriptive Class*	*Dyeing Method*
C.I. Sulphur	Insoluble or partially soluble	Variable slight substantivity	Conventional	1
			Dispersed or specialised conventional	2
C.I. Leuco Sulphur	Soluble	Substantive	Liquid mixtures with Na_2S and/or NaHS	3
			Dry mixtures with Na_2S as reducing agent	4
			Dry mixtures with sodium formaldehyde sulphoxylate as reducing agent	5
C.I. Solubilised Sulphur	Soluble	Non-substantive	Thiosulphonic acid derivatives	6

Method 4
The dye is pasted with a little water at about 30°C, and the paste diluted with 10–12 times its weight of water at the same temperature and allowed to stand for 10 minutes with occasional stirring. The dissolved dye is added to the requisite volume of water in the dye vessel, to which has previously been added 5–40% of common salt or 10–80% of Glauber's salt and a small quantity of anhydrous sodium carbonate. The material is entered and dyed for 45–60 minutes at 25–30°C. On completion of dyeing the material is rinsed and finished in the normal way.

Method 5*
The dye is pasted with water and dissolved by boiling in 10–20 times its weight of soft water. This solution is added to the dyebath containing the necessary volume of water and the temperature is raised to 90–95°C. The material is entered and after 20–30 minutes common salt or Glauber's salt is added as required. On completion of dyeing the material is rinsed and finished in the normal way.

Method 6
The dye is pasted with cold water and dissolved by boiling for a short time in sufficient water to ensure complete dissolution. The solution is added to the dye vessel containing the necessary volume of warm water. Reduction to the substantive form can be made either before or after entering the material. The reducing agent usually employed is sodium sulphide, but sodium hydrosulphide may also be used, as can reducing agents consisting of mixtures of sodium carbonate with glucose, sodium hydrosulphite or sodium formaldehyde sulphoxylate. Additions of common salt from 5–30 g/l are required to assist exhaustion and dyeing is continued at the correct temperature until the desired result is obtained. The material is then rinsed and finished in the normal manner.

When sodium carbonate and sodium hydrosulphite are used, it may be necessary to make small additions of the reducing agent from time to time to keep the bath in good condition.

Aftertreatments
In the tabular layout which has been adopted for the section, the effect of the most commonly used aftertreatments employed to establish a stable hue has been described whenever possible. It is this property which distinguishes different brands and is required when assessing the oxidation characteristics of a particular dye.

Special auxiliaries are also described in the literature for aftertreating material dyed with sulphur dyes, which react with the unoxidised dye and improve the fastness to wet treatments.

Fastness Properties
It is impossible to differentiate with any degree of certainty between material dyed with C.I. Sulphur dyes, C.I. Leuco Sulphur dyes and C.I. Solubilised Sulphur dyes. It follows that the fastness properties are similar and consequently no attempt has been made to draw any distinction between the three groups in this respect.

Textile Usage
In addition to general use in batch processes, sulphur dyes are nowadays being used much more extensively in pad–steam processes. All types can be applied in this way but the C.I. Leuco Sulphur liquid dyes and the C.I. Solubilised Sulphur dyes are especially suitable. Also worthy of note is the increasing use of the C.I. Solubilised Sulphur dyes in pad–jig processes.

The C.I. Leuco Sulphur dyes applied by method 4 are specially suitable for dyeing viscose rayon because of the low application temperature. The C.I. Solubilised Sulphur dyes are used on all forms of cotton and viscose rayon but especially for goods in which penetration, appearance and handle are of importance but not achievable with dyes listed under the complementary C.I. Sulphur and C.I. Leuco Sulphur headings.

In addition to the application methods listed on page 3649, methods have been described involving high temperature baking in the presence of sulphur-containing chemicals such as thiourea and acid forming catalysts. Baking may be done in conjunction with anticrease treatments.

Non-Textile Usage
Leather—This class of dye can only be used on leathers capable of resisting alkali, e.g. oil-tanned leather. Only certain brands and, in particular, the Leuco and Solubilised dyes are suitable and then only in presence of a protective agent.

A table of sulphur dyes suitable for application to leather was included in the Leather Dyes Section of the Supplement to the 2nd Edition (see pages S243–245).

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C.I. Sulphur Yellow 1—3

C.I. Sulphur Yellow	1	2	Leuco 2	Sol. 2	3
C.I. CONSTITUTION NUMBER	53040	53120	53120	53121	53125
HUE	Dull Reddish Yellow	Greenish Yellow→Reddish Yellow			Dull Reddish Yellow
Artificial light (tungsten)	—	Redder			Redder
REACTIONS ON CELLULOSE					
Alkaline sodium dithionite	Little change	Little change			
Sodium hypochlorite	Almost completely destroyed	Almost completely destroyed			
H_2SO_4 conc.	Dull orange	Dull orange			
DYEING					
Method	1	1	3	6	1
Optimum dyeing temp. °C	85–95	85–90	85–90	90	80–90
Solubility in Na_2S	Good	Good			Good
Exhaustion	Very good	Very good			Good
Dyeing rate	Rapid above 40°C	Rapid above 40°C	Rapid above 40°C		
Solubility in water				Very good	
Remarks		Requires high concentration of Na_2S for dissolving		Some brands slightly substantive in water solution	
AFTERTREATMENT					
Acetic acid (1)					
Acetic acid and chrome (2)					
Acetic acid, chrome and copper (3)	Redder, duller	Redder, duller			Much duller
Peroxy compounds (4)		Trace greener			

FASTNESS									
Testing method	ISO Direct	ISO *	AATCC	ISO	ISO *	AATCC	ISO	ISO *
Acid (organic)	3–4	—	4	3–4	4–5	—	4–5	—
Alkali	4–5	—	5	4	4	—	5	—
Cross dyeing, acid	5	—	4	4–5	4–5	—	4	—
chrome	4	—	3–4	4–5	4–5	—	—	—
Hot pressing	5	—	5	4–5	4–5	5	5	—
Light ⅛–½ normal	1	3	—	1–2	3	—	2	—
normal	1–2	3–4	3	2	4	3	3–4	3–4
2× normal	2	4	—	3	5	—	4	6
Mercerising	—	—	—	5, 4–5	—	—	—	—
Milling	3	—	2	4	4	—	4	—
Perspiration	—	—	—	4–5	—	—	—	—
Washing moderate	4	—	—	4	4	5	4	—
severe	2–3	—	2	3	4	—	—	—
	*Aftertreatment 3		*Aftertreatment 3			*Aftertreatment 3		

USAGE AND NOTES		Leather: occasional use for oil tanned leather	

C.I. Sulphur Yellow	4	Leuco 4	Sol. 4	5	Sol. 5	6
C.I. CONSTITUTION NUMBER	53160	53160	53161			53105
HUE	Yellow			Yellow		Dull Yellow→Dull Reddish Yellow
Artificial light (tungsten)						
REACTIONS ON CELLULOSE						
Alkaline sodium dithionite						Little change
Sodium hypochlorite	Almost completely destroyed					Almost completely destroyed
H_2SO_4 conc.						Yellowish brown →brown
DYEING						
Method	1	3	6	1	6	1
Optimum dyeing temp. °C	80–90	80–90	80–90	90	90	90
Solubility in Na_2S	Good	—	—			Good
Exhaustion	Good	Good	Good			
Dyeing rate						Fairly rapid
Solubility in water	—		Good		Very good	—
Remarks				Acetic acid aftertreatment recommended to develop the correct hue		
AFTERTREATMENT						
Acetic acid (1)				Greener than when untreated		
Acetic acid and chrome (2)				Duller		
Acetic acid, chrome and copper (3)	Duller and redder			Considerably greener and duller		Redder and duller
Peroxy compounds (4)	Slightly brighter H_2O_2 and acetic gives the correct hue			Somewhat brighter		
FASTNESS						
Testing method	AATCC	ISO	ISO *	ISO	ISO *	ISO / ISO *
Acid (organic)	5	3–4	4	4–5	5	3 / —
Alkali	5	4	2–3	4–5	4–5	4–5 / —
Cross dyeing, acid	3	4	—	4, 5, 4–5	4, 5, 4	4 / —
chrome	5	—	—	—	—	3 / —
Hot pressing	5	4	4	4–5	4–5	5 / 5
Light ⅓–½ normal	2	1–2	3	4	5	1–2 / 3–4
normal	3	2	3–4	4–5	5–6	3 / 5
2× normal	3	2–3	4	5	6	3–4 / 5–6
Mercerising	—	—	—	5, 4	—	— / —
Milling	4	3–4	3–4	4, 4–5, 5	4, 4–5, 5	4 / —
Perspiration	—	—	—	4–5	—	— / —
Washing moderate	4	4–5	4	4–5, 5, 5	4–5, 5, 5	5 / 5
severe	—	3	—	4, 4, 4–5	4, 4, 4	4–5 / 5
	*Aftertreatment 3			*Aftertreatment 3		*Aftertreatment 3
USAGE AND NOTES	Selected brands for leather dyeing					

Leuco 7	8	9	Leuco 9	10	11	C.I. Sulphur Yellow
53037	53225	53010	53010		—	C.I. CONSTITUTION NUMBER
Yellow	Yellow	Yellow		This C.I. Generic Name is no longer in use	Dull Yellow Redder	HUE Artificial light (tungsten)
		No appreciable change Partially destroyed Dull orange				REACTIONS ON CELLULOSE Alkaline sodium dithionite Sodium hypochlorite H_2SO_4 conc.
4 25–30 Originally developed for viscose rayon, dyed cold	1 80–90 Good	1 90 Good Very good Rapid above 40°C Used as a yellowing component with C.I. Sulphur Green 14 for bright greens	3 90 Very good		1 Good	DYEING Method Optimum dyeing temp. °C Solubility in Na_2S Exhaustion Dyeing rate Solubility in water Remarks
Much redder	Browner and duller	Redder and duller Brighter, slightly weaker			Recommended to develop final hue Greener Duller	AFTERTREATMENT Acetic acid (1) Acetic acid and chrome (2) Acetic acid, chrome and copper (3) Peroxy compounds (4)

ISO	ISO *	ISO	ISO *	ISO	ISO *	AATCC	AATCC *	FASTNESS
2–3	—	3–4	4	3–4	—	3	5	Testing method
4	—	3–4	4	4	—	5	—	Acid (organic)
3–4	—	4	4	5	—	—	—	Alkali
—	—	—	—	4	—	—	—	Cross dyeing, acid
4–5	—	4	4	5	—	5	—	chrome
								Hot pressing
—	—	2	4	2	3	—	—	Light $\frac{1}{3}$–$\frac{1}{2}$ normal
3–4	5	3	5	3	3–4	4–5	—	normal
—	—	4	6	4	4–5	—	—	2× normal
—	—	—	—	—	—	—	—	Mercerising
—	—	3	4	4–5	—	—	—	Milling
—	—	—	—	—	—	—	—	Perspiration
4	—	—	—	4–5	5	3	5	Washing moderate
3–4	—	3–4	3–4	4	4	—	—	severe
*Aftertreatment 3				*Aftertreatment 3		*Aftertreatment 2		

Occasional use on leather		Occasional use on leather				USAGE AND NOTES

C.I. Sulphur Yellow	12	Leuco 12	13	14	Leuco 15
C.I. CONSTITUTION NUMBER	53150	53150			
HUE	Dull Reddish Yellow		Yellow	Dull Greenish Yellow	Reddish Yellow
Artificial light (tungsten)			Redder		
REACTIONS ON CELLULOSE					
Alkaline sodium dithionite			Orange		
Sodium hypochlorite			Yellowish brown		
H_2SO_4 conc.			Redder		Yellowish brown
DYEING					
Method	1	4	1	1	3
Optimum dyeing temp. °C	90–95		80–90	80–90	
Solubility in Na_2S			Moderate	Good	
Exhaustion			Good	Good	
Dyeing rate					
Solubility in water					
Remarks	Has slight fastness to chlorine			Soluble in NaOH	
AFTERTREATMENT					
Acetic acid (1)					
Acetic acid and chrome (2)					
Acetic acid, chrome and copper (3)				Redder	
Peroxy compounds (4)					
FASTNESS					
Testing method	ISO	ISO *	ISO	ISO *	ISO	ISO *	AATCC
Acid (organic)	—	—	4	4	4–5	4–5	—
Alkali	4–5	—	4	4	4	4	—
Cross dyeing, acid	5	—	3	4	4	5	—
chrome	—	—	—	—	—	—	—
Hot pressing	5	—	4	4	4	4	5
Light ⅓–½ normal	—	—	2	4–5	4	6	—
normal	5	6–7	3	5–6	4–5	6–7	4
2× normal	—	—	4	6–7	5	7	—
Mercerising	—	—	—	—	—	—	—
Milling	—	—	4, 4	3, 4	4–5	4–5	—
Perspiration	—	—	—	—	—	—	—
Washing moderate	5	5	—	—	4–5	4–5	4
severe	5	5	4, 3	3, 4	4	4	—
	*Aftertreatment 3		*Aftertreatment 3		*Aftertreatment 3		
USAGE AND NOTES				On oil tanned leather	Leather dyeing Wood dyeing or staining

C.I. Sulphur Orange 1—2

C.I. Sulphur Orange	1	Leuco 1	Sol. 1	2
C.I. CONSTITUTION NUMBER	53050	53050	53051	53145
HUE	Yellowish Orange→Reddish Orange			Yellowish Orange
Artificial light (tungsten)	Redder			
REACTIONS ON CELLULOSE				
Alkaline sodium dithionite	Little change			
Sodium hypochlorite	Almost completely destroyed. Residue is yellow			
H_2SO_4 conc.	Yellowish brown—brown			
DYEING				
Method	1	3	6	1
Optimum dyeing temp. °C	80–90	80–90	80–90	90
Solubility in Na_2S	Good			Good
Exhaustion	Good		Good	Good
Dyeing rate	Fairly rapid			
Solubility in water			Very good	
Remarks				
AFTERTREATMENT				
Acetic acid (1)				Recommended to develop correct hue
Acetic acid and chrome (2)				
Acetic acid, chrome and copper (3)	Redder and duller			
Peroxy compounds (4)				
FASTNESS				
Testing method	AATCC	ISO	ISO*	ISO
Acid (organic)	3–4	3–4	4–5	3
Alkali	4	4	4	4–5
Cross dyeing, acid	4	4–5	4–5	5
chrome	3	3	—	—
Hot pressing	3	4–5	4–5	2–3
Light ⅓–½ normal	3	2	4	3
normal	4	2–3	5	4
2× normal	5	3–4	5–6	5
Mercerising	—	—	—	—
Milling	—	3–4	4	—
Perspiration	—	—	—	—
Washing moderate	—	4–5	5	5
severe	4	4	4–5	4
	*Aftertreatment 3			
USAGE AND NOTES	Leather			

C.I. Sulphur Orange	3	Leuco 3	Sol. 3	4
C.I. CONSTITUTION NUMBER	53105	53105	53106	53152
HUE	Yellowish Orange			Orange
Artificial light (tungsten)				
REACTIONS ON CELLULOSE				
Alkaline sodium dithionite	Little change			
Sodium hypochlorite	Almost completely destroyed			
H_2SO_4 conc.	Yellowish brown			
DYEING				
Method	1	3	6	1†
Optimum dyeing temp. °C	90–95	90–95	90–95	90–95
Solubility in Na_2S	Very good			Very good
Exhaustion	Good		Very good	
Dyeing rate				
Solubility in water			Good	Partially soluble
Remarks				†Some brands may be applied by method 4
AFTERTREATMENT				
Acetic acid (1)				
Acetic acid and chrome (2)				
Acetic acid, chrome and copper (3)	Redder and duller			Redder and duller
Peroxy compounds (4)				

FASTNESS				
Testing method	ISO	ISO *	ISO	ISO *
Acid (organic)	4	4	4	—
Alkali	4	4	4–5	—
Cross dyeing, acid	4	—	4–5	—
chrome	3–4	—	—	—
Hot pressing	4	—	5	—
Light ½–½ normal	1–2	3–4	2–3	4
normal	3	5	4–5	5
2× normal	3–4	5–6	5	5
Mercerising	—	—	—	—
Milling	4	—	4–5	—
Perspiration	—	—	—	—
Washing moderate	5	—	5	5
severe	4	—	3–4	3–4
	*Aftertreatment 3		*Aftertreatment 3	

USAGE AND NOTES			Leather For colouring liquid soap and detergents	

C.I. Sulphur Red 1—4

C.I. Sulphur Red	1	Leuco 1	2	3	Sol. 3	4	Leuco 4
C.I. CONSTITUTION NUMBER	53721	53721	53260	53710	53711	53730	53730
HUE	Dull Red		Dull Bordeaux	Dull Bordeaux		Dull Red	
Artificial light (tungsten)	Yellower						
REACTIONS ON CELLULOSE							
Alkaline sodium dithionite	Yellower						
Sodium hypochlorite	Bleached						
H_2SO_4 conc.							
DYEING							
Method	1	3	1	1	6	1	
Optimum dyeing temp. °C	60–80	60–80	20–50			50–75	25–30
Solubility in Na_2S	Good		Good				
Exhaustion	Good						
Dyeing rate							
Solubility in water							
Remarks	Unsuitable for goods to be rubber proofed			Certain brands may be applied by method 6			
AFTERTREATMENT							
Acetic acid (1)	Recommended to develop correct hue					Recommended to develop correct hue	
Acetic acid and chrome (2)							
Acetic acid, chrome and copper (3)	Yellower and duller						
Peroxy compounds (4)						Brighter	

FASTNESS									
Testing method	AATCC	ISO	ISO *	ISO	ISO *	ISO	ISO *	ISO	ISO *
Acid (organic)	4–5	4–5	5	4	4	3–4	—	4	4
Alkali	2	2	—	4	4	3–4	—	4	—
Cross dyeing, acid	3	3	4	4	—	3–4	—	3	4–5
chrome	2	2	4	—	—	—	—	—	—
Hot pressing	4	4	3–4	4	—	4	—	4	4
Light ⅓–½ normal	4	2	3–4	2	—	2	2–3	3	4
normal	5	3	5	3	5	3–4	4–5	4	5
2× normal	5–6	4–5	5–6	4	—	4–5	5–6	4–5	5–6
Mercerising	—	—	—	—	—	—	—	—	—
Milling	2	3	2–3	—	—	—	—	3	—
Perspiration	—	—	—	—	—	—	—	—	—
Washing moderate	—	—	—	3–4	4–5	3–4	—	2–3	3–4
severe	3	3	3–4	2–3	—	2	—	—	—
	*Aftertreatment 3			*Aftertreatment 3		*Aftertreatment 3		*Aftertreatment 3	
USAGE AND NOTES	Leather					Leather		Some brands for leather	

C.I. Sulphur Red	5	Leuco 5	6	Leuco 6	Sol. 6
C.I. CONSTITUTION NUMBER	53830	53830	53720	53720	53723
HUE			Bordeaux		
Artificial light (tungsten)			Little yellower		
REACTIONS ON CELLULOSE					
Alkaline sodium dithionite			Yellow brown, colour returns on oxidation and acidification		
Sodium hypochlorite			Almost completely destroyed		
H_2SO_4 conc.			Dark brown		
DYEING					
Method	1	3	1	3	6
Optimum dyeing temp. °C	60–80	60–80	50–90	50–70	50–60
Solubility in Na_2S			Readily soluble		
Exhaustion			Good	Good	
Dyeing rate		Slow			
Solubility in water					Very good
Remarks	Has better fastness to chlorine than most sulphur dyes		Although readily soluble maximum solubility is not very high		
AFTERTREATMENT					
Acetic acid (1)			Recommended to develop the correct hue		
Acetic acid and chrome (2)			Redder, slightly duller		
Acetic acid, chrome and copper (3)	Duller		Yellower, slightly duller		
Peroxy compounds (4)			Slightly brighter, slightly yellower		

FASTNESS					
Testing method	AATCC	ISO	AATCC	ISO	ISO *
Acid (organic)	5	5	4–5	4	4–5
Alkali	2	4–5	2	2	2–3
Cross dyeing, acid	4	4	4	4	4–5
chrome	4	—	2	—	—
Hot pressing	5	4	4	4	4
Light ½–½ normal	4–5	4	4	2–3	4
normal	5	5	5	3–4	5
2× normal	6	6	6	4–5	5–6
Mercerising	—	—	—	†yellower	—
Milling	4	—	2	2–3	2–3
Perspiration	—	—	—	(Alk) 3–4, 2–3, 4	—
Washing moderate	3	4–5	—	3–4	4
severe	—	2–3	3	2–3	3

*Aftertreatment 3 †Apparent increase in depth

USAGE AND NOTES			Selected brands for leather dyeing		

7	Sol. 7	8	9	10	C.I. Sulphur Red
53810	53811			53228	C.I. CONSTITUTION NUMBER
Dull Bluish Red		Bordeaux Yellower	Bordeaux	Bordeaux Much yellower	HUE Artificial light (tungsten)
				Yellow	REACTIONS ON CELLULOSE Alkaline sodium dithionite Sodium hypochlorite H_2SO_4 conc.
1 50–60 Some dispersed brands may be applied by method 6	6 50–60	1 90–95 Good Has slight fastness to chlorine	1 60–90	1 90 Very good Very good Has moderate fastness to chlorine	DYEING Method Optimum dyeing temp. °C Solubility in Na_2S Exhaustion Dyeing rate Solubility in water Remarks
				Yellower Brighter and weaker	AFTERTREATMENT Acetic acid (1) Acetic acid and chrome (2) Acetic acid, chrome and copper (3) Peroxy compounds (4)
ISO		AATCC	ISO	ISO	FASTNESS Testing method
4 3 3 — 5		5 2 — — 5	4–5 3 — — 5	4 2–3 4, 4–5, 4–5 — 5	Acid (organic) Alkali Cross dyeing, acid chrome Hot pressing
4–5 5 5–6		— 4–5 —	— 3 —	4 5–6 6–7	Light $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal
— — — 4 2		— — — 3 —	— — — 3 —	— 4, 3–4, 4 — 4, 4, 5 3–4, 4	Mercerising Milling Perspiration Washing moderate severe
					USAGE AND NOTES

C.I. Sulphur Violet 1—3

C.I. Sulphur Violet	1	Leuco 1	Sol. 1	2	3	Leuco 3
C.I. CONSTITUTION NUMBER	53410	53410	53411	53760	53780	53780
HUE						
Artificial light (tungsten)	Violet			Violet	Reddish Violet	
REACTIONS ON CELLULOSE						
Alkaline sodium dithionite	Dull olive, returns on oxidation					
Sodium hypochlorite	Destroyed					
H_2SO_4 conc.	Reddish brown					
DYEING						
Method	1	3	6	1	1	4
Optimum dyeing temp. °C	70–90	70–90	70–90	90–95	50–60	25–30
Solubility in Na_2S	Good					
Exhaustion	Good	Good				
Dyeing rate	Moderate					
Solubility in water			Good			
Remarks				Some brands should be applied without Na_2CO_3 or NaCl		
AFTERTREATMENT						
Acetic acid (1)	Recommended for some brands to develop the correct hue					
Acetic acid and chrome (2)	Slightly duller					
Acetic acid, chrome and copper (3)	Slightly redder, duller			Slightly bluer, duller		
Peroxy compounds (4)	Slightly redder, slightly brighter			Slightly brighter	Slightly brighter	
FASTNESS						
Testing method	ISO			ISO	ISO *	ISO
Acid (organic)	3–4			3	3–4	2–3
Alkali	4–5			4–5	4–5	4
Cross dyeing, acid	4–5			2–3	3	2
chrome	3			—	—	—
Hot pressing	5			3–4	3–4	4
Light ⅓–½ normal	4–5			3	3	3
normal	5			3–4	3–4	4
2× normal	5–6			4–5	4–5	4–5
Mercerising	†			—	—	—
Milling	—			3	3	—
Perspiration	(Alk) 5			—	—	—
Washing moderate	4–5			3–4	—	3–4
severe	3–4			2–3	3–4	—
USAGE AND NOTES						

†Apparent increase in depth

*Aftertreatment 3

C.I. Sulphur Violet	4	5	
C.I. CONSTITUTION NUMBER	53700	53442	
HUE	Reddish Violet		
Artificial light (tungsten)			
REACTIONS ON CELLULOSE			
Alkaline sodium dithionite			
Sodium hypochlorite			
H_2SO_4 conc.			
DYEING			
Method	1	1	
Optimum dyeing temp. °C	80–90		
Solubility in Na_2S			
Exhaustion			
Dyeing rate			
Solubility in water			
Remarks	Some brands are dyed in a cooling bath without Na_2CO_3 or NaCl		
AFTERTREATMENT			
Acetic acid (1)			
Acetic acid and chrome (2)			
Acetic acid, chrome and copper (3)	Bluer, duller		
Peroxy compounds (4)			

FASTNESS					
Testing method	AATCC	ISO	ISO		
Acid (organic)	4	4	4–5		
Alkali	2	3–4	3–4		
Cross dyeing, acid	1	1–2	1–2		
chrome	1	—	—		
Hot pressing	4–5	4	4		
Light ⅛–½ normal	2–3	3	4		
normal	3–4	4	4–5		
2× normal	4	4–5	5–6		
Mercerising	—	—	—		
Milling	3	—	—		
Perspiration	—	—	—		
Washing moderate	4	3–4	—		
severe	1	2	—		
*Aftertreatment 3					

USAGE AND NOTES			

C.I. Sulphur Blue 1—2

C.I. Sulphur Blue	1	Leuco 1	Sol. 1	2	Leuco 2	Sol. 2
C.I. CONSTITUTION NUMBER	53235	53235	53236	53480	53480	53481
HUE						
Artificial light (tungsten)	Navy (oxidised)→Bluish Black (Direct)			Blue		
REACTIONS ON CELLULOSE						
Alkaline sodium dithionite	Pale olive, returning to original on oxidation			Yellow, returning to original on oxidation		
Sodium hypochlorite	Bleached			Bleached		
H_2SO_4 conc.	Black					
DYEING						
Method	1	3	6	1	4	6
Optimum dyeing temp. °C	85–95	85–95	85–95	60–80	25–30	50–60
Solubility in Na_2S	Good			Very soluble		
Exhaustion	Good					
Dyeing rate	Moderate					
Solubility in water			Very good	Slight solubility		Good
Remarks	Avoid excessive oxidation during dyeing, which can cause bronzing		Less tendency to bronzing than C.I. Sulphur Blue 1		Originally introduced for dyeing viscose cold	May also be dyed with sodium dithionite
AFTERTREATMENT						
Acetic acid (1)	Redder					
Acetic acid and chrome (2)	Redder, brighter			Somewhat redder, duller		
Acetic acid, chrome and copper (3)	Redder, slightly brighter			Slightly redder, duller		
Peroxy compounds (4)	Redder, much brighter			Brighter, redder		
FASTNESS						
Testing method	AATCC	ISO	ISO *		ISO	ISO *
Acid (organic)	4–5	4	4		3	3–4
Alkali	3–4	4	3–4		4	4
Cross dyeing, acid	4	4–5	5		4	4
chrome	—	3–4	—		—	—
Hot pressing	4–5	4–5	5		4	4
Light $\frac{1}{3}$–$\frac{1}{2}$ normal	3	4	4		4	4
normal	4	5	5		4–5	4–5
2× normal	5	6	6		5	5
Mercerising	—	†Redder	—		—	—
Milling	4	4	3–4		3	3
Perspiration	—	—	—		—	—
Washing moderate	4	5	5		3	—
severe	4	4–5	4–5		2–3	2–3
	*Aftertreatment 3	†Apparent increase in depth		*Aftertreatment 3		
USAGE AND NOTES	Selected makes used for direct printing and leather dyeing Suitable for goods to be given a resin finish including delayed cure finishes			Slightly greener than C.I. Sulphur Blue 10 Selected makes used on leather		

C.I. Sulphur Blue	3	Leuco 3	4	Sol. 4	5	Leuco 5	Sol. 5
C.I. CONSTITUTION NUMBER	53235	53235	53235	53236	53235	53235	53236
HUE	Navy		Reddish Navy→Bluish Violet		Navy→Reddish Navy		
Artificial light (tungsten)	Redder and duller		Redder and duller		Redder and duller		
REACTIONS ON CELLULOSE							
Alkaline sodium dithionite	Pale olive, returning to original on oxidation		Pale olive, returning to original on oxidation		Pale olive, returning to original on oxidation		
Sodium hypochlorite	Bleached		Bleached		Bleached		
H_2SO_4 conc.	Black		Black		Black		
DYEING							
Method	1	3	1	6	1	3	6
Optimum dyeing temp. °C	85–95	85–95	85–95	90	85–95	85–95	85–95
Solubility in Na_2S	Good		Moderate		Good		
Exhaustion	Good		Good		Good		Good
Dyeing rate	Moderate	Moderate			Moderate		
Solubility in water				Very soluble			Very good
Remarks	Avoid excessive oxidation during dyeing, which can cause bronzing			Specially suitable for pad/jig and pad/steam processes			May be dyed with sodium dithionite
AFTERTREATMENT							
Acetic acid (1)			Slightly redder		Slightly redder		
Acetic acid and chrome (2)	Redder		Redder, duller		Redder, slightly duller		
Acetic acid, chrome and copper (3)	Redder, duller		Redder, much duller		Redder, duller		
Peroxy compounds (4)	Brighter		Brighter		Brighter		

FASTNESS								
Testing method	AATCC	ISO	AATCC	ISO	ISO *	AATCC	ISO	ISO *
Acid (organic)	4–5	3	4–5	5	4	4–5	4	4
Alkali	3–4	4–5	3–4	5	4	3–4	4	4
Cross dyeing, acid	4	4–5	4–5	4–5	5	4	4–5	5
chrome	—	—	4	4	—	4	3	—
Hot pressing	4–5	4	4–5	—	5	4–5	5	5
Light ⅓–½ normal	3	4	3	4–5	—	3	4–5	4
normal	4	5	4	5–6	—	4	5	5
2× normal	5	6	5	6	—	5	5–6	6
Mercerising	—	—	—	—	—	—	†R	—
Milling	4	4	4	4	4	4	4	3–4
Perspiration	—	—	—	†Redder	—	—	5	5
Washing moderate	4	4	4	5	—	4	4–5	—
severe	3–4	2–3	4	4	5	4	4	4

*Aftertreatment 3 †Apparent increase in depth

USAGE AND NOTES	Selected brands for direct printing and leather Suitable for goods to be given a resin finish, including delayed cure	Selected brands used for direct prints and on leather Suitable for goods to be given a resin finish, including delayed cures	Selected brands for direct printing and leather dyeing Suitable for goods to be given a resin finish, including delayed cures

6	Sol. 6	7	Leuco 7	Sol. 7	8	Leuco 8	C.I. Sulphur Blue
53460	53461	53440	53440	53441	—	—	C.I. CONSTITUTION NUMBER
Blue		Reddish Blue→Bluish Violet			Greenish Blue		HUE Artificial light (tungsten)
		Pale yellowish olive, returning to original on oxidation			Orange, returning to normal on oxidation		REACTIONS ON CELLULOSE Alkaline sodium dithionite
		Bleached					Sodium hypochlorite
		Dark purple					H_2SO_4 conc.
1	6	1	3 or 4	6	1	3	DYEING Method
90	90	50–80 Very good Good Moderate	50–80 or 25	50–90 Moderate	80–85	80–85	Optimum dyeing temp. °C Solubility in Na_2S Exhaustion Dyeing rate Solubility in water
		Some brands prepared in dispersed form may be applied by method 6		May be dyed with sodium dithionate	Lower dyeing temp. may be used to prevent bronzy dyeings		Remarks
		Slightly redder, slightly duller			Slightly redder		AFTERTREATMENT Acetic acid (1)
		Redder, duller					Acetic acid and chrome (2)
Brighter		Brighter, slightly redder					Acetic acid, chrome and copper (3) Peroxy compounds (4)
ISO		AATCC	ISO	ISO *	AATCC		FASTNESS Testing method
4		5	4	—	5		Acid (organic)
4–5		5	4–5	—	5		Alkali
4		4	3–4	—	—		Cross dyeing, acid
—		4	3	—	—		chrome
4		4–5	3–4	5	5		Hot pressing
5		4–5	3–4	4–5	—		Light $\frac{1}{3}$–$\frac{1}{2}$ normal
6		5–6	4–5	5–6	6		normal
6–7		6	5–6	6	—		2× normal
—		—	†R	—	—		Mercerising
—		4	3–4	—	—		Milling
—		—	(Alk) 4–5	—	—		Perspiration
4		—	4	—	—		Washing moderate
3		4–5	3	4–5	2–3		severe
		*Aftertreatment 3 †Apparent increase in depth					
		Selected brands for direct printing Leather dyeing. Paper dyeing					USAGE AND NOTES

C.I. Sulphur Blue	9	Leuco 9	10	Sol. 10	11	Leuco 11	Sol. 11
C.I. CONSTITUTION NUMBER	53430	53430	53470	53471	35	53235	53236
HUE	Bright Blue		Blue		Reddish Navy		
Artificial light (tungsten)			Greener and duller		Redder and duller		
REACTIONS ON CELLULOSE							
Alkaline sodium dithionite			Yellow, returning to original on oxidation		Pale olive, returning to original on oxidation		
Sodium hypochlorite			Bleached		Bleached		
H_2SO_4 conc.					Black		
DYEING							
Method	1	3	1	6	1	3	6
Optimum dyeing temp. °C	60–90	60–90	50–60	50–60	85–90	85–90	85–90
Solubility in Na_2S	Moderate		Good		Good		
Exhaustion	Good		Moderate		Good		Good
Dyeing rate				Slow	Moderate		
Solubility in water			Slight	Very good			Good
Remarks					Tendency to bronziness in strong dyeings with excessive oxidation during dyeing		
AFTERTREATMENT							
Acetic acid (1)			Greener		Slightly redder		
Acetic acid and chrome (2)	Redder				Slightly redder, slightly duller		
Acetic acid, chrome and copper (3)	Duller		Slightly greener, duller		Redder, duller		
Peroxy compounds (4)	Brighter		Brighter, redder		Brighter, redder		

FASTNESS Testing method	AATCC	ISO	ISO *	AATCC	ISO
Acid (organic)	5	4–5	—	5	4–5
Alkali	4–5	5	—	4	4–5
Cross dyeing, acid	—	4	—	—	3–4
chrome	—	—	—	3–4	3–4
Hot pressing	4–5	4	—	4–5	4
Light ⅓–½ normal	4	3	3	4	4–5
normal	4–5	4–5	5	5–6	5–6
2× normal	5–6	5	5–6	6	6–7
Mercerising	—	—	—	—	4–5 R
Milling	4	3–4	—	—	2–3
Perspiration	—	—	—	—	4
Washing moderate	4	4–5	4–5	—	3–4
severe	2–3	3	4	3	2–3

*Aftertreatment 3

USAGE AND NOTES	Selected brands occasionally used for dyeing oil-tanned leather and for paper	Selected brands for paper and oil-tanned leather	Suitable for goods to be given a resin finish, including delayed cures Leather dyeing

12	13	Leuco 13	Sol. 13	14	C.I. Sulphur Blue
53800	53450	53450	53452	53400	C.I. CONSTITUTION NUMBER
Reddish Blue	Dark Blue→Blue Slightly redder			Dull Blue	**HUE** Artificial light (tungsten)
	Pale yellow, returning to original on oxidation Bleached Black				**REACTIONS ON CELLULOSE** Alkaline sodium dithionite Sodium hypochlorite H_2SO_4 conc.
1 with $Na_2S_2O_4$ Cold or 50–60	1 50–85 Fair Good Requires care when dissolving the dye. Additions of sodium dithionite useful	3 50–85	6 50–85 Good May be dyed with sodium dithionite	1 90	**DYEING** Method Optimum dyeing temp. °C Solubility in Na_2S Exhaustion Dyeing rate Solubility in water Remarks
Brighter	Slightly brighter Much duller Brighter				**AFTERTREATMENT** Acetic acid (1) Acetic acid and chrome (2) Acetic acid, chrome and copper (3) Peroxy compounds (4)
ISO 3–4 4 3–4 — 4–5 4 4–5 5 — — — 3–4 2	AATCC 4 5 — — 4 — 5 — — 4 — — 4	ISO 4–5 4 4 — 4 3–4 4–5 5–6 †R 4 — 4 4	ISO* 4–5 4 4 — 4 4 4–5 6 — 4 — 4 4	ISO 3 4–5 3–4 — 4 4 4–5 5–6 — — 4 2–3	**FASTNESS** Testing method Acid (organic) Alkali Cross dyeing, acid chrome Hot pressing Light ⅓–½ normal normal 2× normal Mercerising Milling Perspiration Washing moderate severe
	*Aftertreatment 3 †Apparent increase in depth				
	Selected brands for oil-tanned leather and for paper			Aftertreatment 3 improves the fastness to light and wet processing	**USAGE AND NOTES**

C.I. Sulphur Blue	15	Leuco 15	Sol. 15	16	17,18	19
C.I. CONSTITUTION NUMBER	53540	53540	53541			
HUE	Greenish Blue			Navy	These C.I. Generic Names are no longer in use	Blue
Artificial light (tungsten)	Yellower			Slightly redder		Duller
REACTIONS ON CELLULOSE						
Alkaline sodium dithionite	Dull yellow, returning to original on oxidation					
Sodium hypochlorite	Bleached					
H_2SO_4 conc.	Dark blue					
DYEING						
Method	1	3	6	1		1
Optimum dyeing temp. °C	50–90	50–90	50–60	85–95		70–90
Solubility in Na_2S	Good			Good		Very good
Exhaustion	Good		Moderate	Good		Moderate–good
Dyeing rate						
Solubility in water	Slight		Very good			
Remarks						Soaping gives a slightly greener hue Has slight fastness to chlorine
AFTERTREATMENT						
Acetic acid (1)						
Acetic acid and chrome (2)	Slightly bluer, duller					
Acetic acid, chrome and copper (3)	Much bluer, duller					Slightly redder
Peroxy compounds (4)	Brighter, slightly bluer					Slightly brighter, slightly redder
FASTNESS						
Testing method	AATCC	ISO		AATCC		ISO
Acid (organic)	5	3–4		3		4–5
Alkali	4	4		5		3
Cross dyeing, acid	3	3		4		4, 5, 5
chrome	4	2–3		4		—
Hot pressing	4–5	4		—		5
Light ⅓–½ normal	5	4–5		5		3
normal	6	5–6		6		4–5
2× normal	6–7	6		7		5–6
Mercerising	—	†RD		—		—
Milling	3	3–4		—		3–4
Perspiration	—	(Alk) 4–5, 2–3		—		—
Washing moderate	—	4		3		4, 4, 5
severe	3	2		3		4, 4–5
	†Apparent increase in depth					
USAGE AND NOTES	Selected brands for direct printing and for dyeing silk			Suitable for goods to be resin finished		Suitable for goods to be given a resin finish

C.I. Sulphur Green 1—2

C.I. Sulphur Green	1	Leuco 1	Sol. 1	2	Leuco 2	Sol. 2
C.I. CONSTITUTION NUMBER	53166	53166	53167	53571	53571	53572
HUE						
Artificial light (tungsten)	Dull Green			Bluish Green→Green		
				Yellower		
REACTIONS ON CELLULOSE						
Alkaline sodium dithionite				Orange, reverting to original on oxidation		
Sodium hypochlorite				Bleached		
H_2SO_4 conc.				Dark blue		
DYEING						
Method	1	3	6	1	3	6
Optimum dyeing temp. °C	80–90	80–90	80–90	50–80	50–80	50–90
Solubility in Na_2S	Good			Good		
Exhaustion	Good	Good	Good	Good		Good
Dyeing rate	Moderate			Slow		Slow
Solubility in water			Good			Very good
Remarks				Hue slightly yellower when dyed at lower temperatures		
AFTERTREATMENT						
Acetic acid (1)						
Acetic acid and chrome (2)	Slightly bluer, slightly duller			Bluer, slightly duller		
Acetic acid, chrome and copper (3)	Bluer, duller			Bluer, much duller		
Peroxy compounds (4)	Slightly bluer, slightly brighter			Bluer		
FASTNESS						
Testing method	AATCC	AATCC *	ISO	AATCC	ISO	
Acid (organic)	5	—	3–4	5	4–5	
Alkali	5	—	4	3	4	
Cross dyeing, acid	3–4	—	3–4	2	2–3	
chrome	—	—	—	—	2	
Hot pressing	5	—	4–5	5	4–5	
Light ⅓–½ normal	5	—	4–5	4	4–5	
normal	5–6	—	5	5	5–6	
2× normal	6	—	6	6	6	
Mercerising	—	—	†D	—	†B	
Milling	—	—	—	4	3	
Perspiration	—	—	5	—	4–5	
Washing moderate	3	5	4	4	4–5	
severe	—	—	3–4	—	3	
	*Aftertreatment 3 †Apparant increase in depth			†Apparent increase in depth		
USAGE AND NOTES	Unsuitable for goods to be vulcanised			Suitable for goods to be vulcanised Suitable for direct prints on cellulose Occasional use on leather and paper		

C.I. Sulphur Green	3	Leuco 3	Sol. 3	4	Leuco 4	5
C.I. CONSTITUTION NUMBER	53570	53570	53573			53550
HUE	Green			Dull Bluish Green		Dull Bluish Green
Artificial light (tungsten)						
REACTIONS ON CELLULOSE						
Alkaline sodium dithionite	Orange, returning to original on oxidation					
Sodium hypochlorite	Bleached					
H_2SO_4 conc.	Dark blue					
DYEING						
Method	1	3	6	1	3	1
Optimum dyeing temp. °C	50–85	50–85	50–60	90	90	90
Solubility in Na_2S	Good					
Exhaustion	Good					
Dyeing rate	Slow					
Solubility in water			Very good			
Remarks	Increases in the proportion of Na_2S used or higher dyeing temps. gives bluer dyeings					
AFTERTREATMENT						
Acetic acid (1)	Bluer					
Acetic acid and chrome (2)	Much bluer, slightly duller			Bluer, duller		
Acetic acid, chrome and copper (3)	Very much bluer, slightly duller					
Peroxy compounds (4)	Bluer, brighter					

FASTNESS					
Testing method	AATCC	ISO	ISO *	AATCC	ISO
Acid (organic)	5	4	4–5	—	3
Alkali	3–4	4	4–5	—	4–5
Cross dyeing, acid	—	3	3–4	—	3–4
chrome	—	2	—	—	—
Hot pressing	4	4–5	4–5	5	4
Light ⅓–½ normal	3	4	4–5	—	4–5
normal	4	4–5	5	7	5
2× normal	5–6	5–6	6	—	6
Mercerising	—	†B	—	—	—
Milling	4–5	3–4	3–4	—	—
Perspiration	—	4–5	—	—	—
Washing moderate	2	4	5	3	4
severe	1	3	4	—	3

*Aftertreatment 3 †Apparent increase in depth

USAGE AND NOTES	Selected brands for direct prints on cellulose Occasional use on leather and paper Unsuitable for goods to be vulcanised

6	Sol. 6	7	Leuco 7	Sol. 7	8	8:1	C.I. Sulphur Green
53530	53531	53580	53580	53581	53175		C.I. CONSTITUTION NUMBER
Dull Bluish Green		Green			Olive→Dull Yellowish Brown		HUE Artificial light (tungsten)
						Slightly different chemically from C.I. Sulphur Green 8, but similar in properties and usage	REACTIONS ON CELLULOSE Alkaline sodium dithionite Sodium hypochlorite H_2SO_4 conc.
1 50–60 Good Good	6 50–60	1 50–60	3 50–80	6 50–60	1 70–90 Good		DYEING Method Optimum dyeing temp. °C Solubility in Na_2S Exhaustion Dyeing rate Solubility in water Remarks
		May also be dyed at 20–30°C					
		Much bluer, weaker, duller			Greener		AFTERTREATMENT Acetic acid (1) Acetic acid and chrome (2) Acetic acid, chrome and copper (3) Peroxy compounds (4)
ISO		ISO			AATCC ISO		FASTNESS Testing method
3		3			— 3–4		Acid (organic)
4		4–5			— 4		Alkali
3		2–3			4 4–5		Cross dyeing, acid chrome
—		—			— 5		
4		4			4–5 4–5		Hot pressing
3		3			— 4		Light $\frac{1}{3}$–$\frac{1}{2}$ normal
4–5		4			5 4–5		normal
5		4			— 6		2× normal
—		—			— —		Mercerising
—		—			— 4		Milling
—		—			— —		Perspiration
3–4		4			4 4		Washing moderate
2–3		2–3			— 3–4		severe
Selected brands for leather dyeing							USAGE AND NOTES

C.I. Sulphur Green 9—18

C.I. Sulphur Green	9	Sol. 9	10	11	Leuco 11	12	13
C.I. CONSTITUTION NUMBER	53005	53006	53590	53165	53165	53045	
HUE	Dull Green→Greenish Grey		Dull Green	Olive		Olive	
Artificial light (tungsten)	Slightly browner			Yellower			
REACTIONS ON CELLULOSE							This C.I. Generic Name is no longer in use
Alkaline sodium dithionite	Reddish brown						
Sodium hypochlorite	Bleached						
H_2SO_4 conc.	Grey						
DYEING							
Method	1	6	1	1	3	1	
Optimum dyeing temp. °C	90	90	50–60	90	90	70–90	
Solubility in Na_2S				Good			
Exhaustion				Good		Good	
Dyeing rate							
Solubility in water		Very good					
Remarks			May also be dyed cold				
AFTERTREATMENT							
Acetic acid (1)							
Acetic acid and chrome (2)	Duller			Bluer			
Acetic acid, chrome and copper (3)	Much duller						
Peroxy compounds (4)	Bluer, brighter						
FASTNESS							
Testing method	ISO	ISO *	ISO	ISO *	AATCC	ISO	ISO	ISO *
Acid (organic)	4–5	4–5	3	3–4	5	3	4–5	5
Alkali	4	4	5	5	2–3	3	5	5
Cross dyeing, acid	3–4, 4–5	4, 4–5	3	3–4	—	4	4	5
chrome	3–4, 4–5	—	—	—	—	—	—	—
Hot pressing	5	5	4	4	4	4	4–5	4–5
Light ½–½ normal	5	5	—	—	4	4	2	3–4
normal	5–6	6	4	4–5	5	5	3	4
2× normal	6	6	4–5	4–5	5–6	5–6	4	5
Mercerising	4–5	—	—	—	—	—	—	—
Milling	3–4, 4–5	3–4, 4–5	—	—	2	—	—	—
Perspiration	3–4	—	—	—	—	—	—	—
Washing moderate	4, 4–5	4, 4–5	—	—	3	4	5	5
severe	3–4, 3–4	3–4, 3–4	4	4–5	—	3	—	—
	*Aftertreatment 3		*Aftertreatment 3				*Aftertreatment 3	
USAGE AND NOTES				Selected brands for direct prints on cellulose Selected brands for dyeing leather and paper				

14	15	16	Leuco 16	17	18	C.I. Sulphur Green
Chemical Class: Phthalocyanine					53220	C.I. CONSTITUTION NUMBER
Bright Green	Yellowish Olive→ Brownish Olive	Dull Olive			Dull Bluish Green	HUE Artificial light (tungsten)
				This C.I. Generic Name is no longer in use		REACTIONS ON CELLULOSE Alkaline sodium dithionite Sodium hypochlorite H_2SO_4 conc.
1 90 Moderate Good Aftertreatment 2 (or with HCl in the case of some brands) is required to develop the correct hue	60–80	1 90	3 90 Medium-slow		1 90	DYEING Method Optimum dyeing temp. °C Solubility in Na_2S Exhaustion Dyeing rate Solubility in water Remarks
	Slightly greener, duller	Darker				AFTERTREATMENT Acetic acid (1) Acetic acid and chrome (2) Acetic acid, chrome and copper (3) Peroxy compounds (4)
AATCC ISO 5 4 1 4–5 — 4–5 — 4 4–5 3–4 5 6 6 6–7 7 7 — 3–4B 4–5 — — (Alk) 4–5 3 4–5 — 3	ISO ISO* 2–3 3 3 4 3 4–5 — — 3–4 4 3 4 4 5 4–5 5–6 — — 4–5 4–5 — — 4–5 4–5 4–5 4–5 *Aftertreatment 3	AATCC — — — — 5 — 7 — — — — — — 3			ISO 4 4 — — 5 — 5 — — — — 4–5 —	FASTNESS Testing method Acid (organic) Alkali Cross dyeing, acid chrome Hot pressing Light $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Mercerising Milling Perspiration Washing moderate severe
Good fastness to weathering but not suitable for goods to be vulcanised						USAGE AND NOTES

C.I. Sulphur Green	19	Sol. 19	20	21	22
C.I. CONSTITUTION NUMBER				53170	53451
HUE	Olive		Greenish Olive	Dull Green→ Greenish Grey	Bluish Green
Artificial light (tungsten)	Browner				
REACTIONS ON CELLULOSE					
Alkaline sodium dithionite	Reddish Brown				
Sodium hypochlorite	Bleached				
H_2SO_4 conc.	Grey				
DYEING					
Method	1	6	1	1	1
Optimum dyeing temp. °C	90	90	70–95		
Solubility in Na_2S					
Exhaustion					
Dyeing rate					
Solubility in water		Very good			
Remarks					Unsuitable for use on goods to be vulcanised
AFTERTREATMENT					
Acetic acid (1)					
Acetic acid and chrome (2)	Bluer, duller				
Acetic acid, chrome and copper (3)	Bluer, duller		Slightly duller		
Peroxy compounds (4)	Greener, brighter				
FASTNESS					
Testing method	ISO	ISO ■	ISO	ISO ■	
Acid (organic)	4	4	4–5	—	
Alkali	4–5	4–5	3B	—	
Cross dyeing, acid	4–5, 5, 4–5	5, 5, 4	5, 3, 3	—	
chrome	3–4, 4–5, 4–5	4, 4–5, 4	—	—	
Hot pressing	5	5	—	—	
Light ⅓–½ normal	5	5–6	—	—	
normal	6	6–7	4–5	6	
2× normal	6–7	7	—	—	
Mercerising	†4–5	—	—	—	
Milling	4, 4–5, 5	4–5, 4–5, 5	5, 5, 5	5, 5, 5	
Perspiration	4–5	—	—	—	
Washing moderate	4, 4, 5	4–5, 4, 5	5, 5, 5	5, 5, 5	
severe	3, 3	3–4, 3	—	—	
	*Aftertreatment 3 †Apparant increase in depth				
USAGE AND NOTES			*Aftertreated with $CuSO_4$ and acetic acid		See also C.I. Sulphur Blue 13

23	24	25	26	Sol. 26	C.I. Sulphur Green
		Chemical Class: Phthalocyanine			C.I. CONSTITUTION NUMBER
Green	Brownish Olive	Bright Bluish Green Yellower	Greyish Green Practically unchanged		**HUE** Artificial light (tungsten)
		Blue Bleached Olive brown; on dilution—green	Yellowish Olive Bleached Olive green		**REACTIONS ON CELLULOSE** Alkaline sodium dithionite Sodium hypochlorite H_2SO_4 conc.
1 90 Good	1 90	1 90 Good Good	1 90 Good Good	6 90 Very good	**DYEING** Method Optimum dyeing temp. °C Solubility in Na_2S Exhaustion Dyeing rate Solubility in water
		Aftertreatment required to develop the correct hue	Aftertreatment 3 recommended to develop correct hue Air oxidised the hue is considerably yellower and duller		Remarks
Slightly browner	Slightly browner		Somewhat duller Considerably yellower, duller		**AFTERTREATMENT** Acetic acid (1) Acetic acid and chrome (2) Acetic acid, chrome and copper (3) Peroxy compounds (4)
ISO ISO*	ISO ISO*	ISO ISO*	ISO ISO*		**FASTNESS** Testing method
4 —	4–5 —	5 5	4–5 4–5		Acid (organic)
4 —	4 —	3–4 3–4	3 3		Alkali
— —	— —	5 5	4–5 4–5		Cross dyeing, acid
— —	— —	— —	— —		chrome
— —	4–5 —	5 5	5 5		Hot pressing
4 4–5	3–4 5	6–7 6–7	6–7 6–7		Light $\frac{1}{3}$–$\frac{1}{2}$ normal
5 5–6	4–5 5–6	7 7	6–7 6–7		normal
6 6–7	5 6	7 7	6–7 6–7		2× normal
— —	— —	— —	4–5 —		Mercerising
3 —	3–4 —	4–5 4–5	3–4 3		Milling
— —	— —	— —	4 —		Perspiration
3–4 4	4 5	5 5	3–4 4		Washing moderate
3 3–4	2–3 3–4	4–5 4–5	3–4 3–4		severe
*Aftertreatment 3	*Aftertreatment 3	*Aftertreatment 3	*Aftertreatment 3		
		Unsuitable for goods to be vulcanised	Suitable for goods to be given resin finishes		**USAGE AND NOTES**

C.I. Sulphur Green	27	Sol. 27	28	29	Leuco 30
C.I. CONSTITUTION NUMBER					
HUE	Olive		Greenish Grey→ Olive Very slightly redder	Olive	Bluish Olive
Artificial light (tungsten)					
REACTIONS ON CELLULOSE					
Alkaline sodium dithionite					
Sodium hypochlorite			Bleached		
H_2SO_4 conc.					
DYEING					
Method	1	6	1	1	3
Optimum dyeing temp. °C	90–95	90–95	95–100	95	
Solubility in Na_2S				Good	
Exhaustion	Moderate		Good	Good	
Dyeing rate					
Solubility in water					
Remarks	Certain brands in disperse form may be applied by method 6		Aftertreatment not recommended		
AFTERTREATMENT					
Acetic acid (1)				Recommended to develop correct hue	
Acetic acid and chrome (2)					
Acetic acid, chrome and copper (3)	Duller			Greener	
Peroxy compounds (4)					

FASTNESS						
Testing method	ISO	ISO *	AATCC	ISO	ISO *	AATCC
Acid (organic)	5	5	5	3–4	4	—
Alkali	5	5	5	3	3–4	—
Cross dyeing, acid	—	—	4	3	4–5	—
chrome	—	—	4	2–3	3	—
Hot pressing	5	5	5	4	5	4–5
Light ⅓–½ normal	—	—	—	4–5	6	—
normal	5	5	—	5–6	6–7	4
2× normal	—	—	5–6	6–7	7	5
Mercerising	—	—	—	—	—	—
Milling	—	—	4	3–4	4	—
Perspiration	—	—	—	—	—	—
Washing moderate	4	4–5	—	3–4	4	4–5
severe	4–5	4–5	(IIIA) 5	—	—	—
	*Aftertreatment 3			*Aftertreatment 3		
USAGE AND NOTES						Leather Staining wood

31	32	33		C.I. Sulphur Green
				C.I. CONSTITUTION NUMBER
Bluish Green	Brownish Olive	Brownish Olive		**HUE** Artificial light (tungsten)
				REACTIONS ON CELLULOSE Alkaline sodium dithionite Sodium hypochlorite H_2SO_4 conc.
1 80–90 Moderate	1 100 Good	1 100 Good		**DYEING** Method Optimum dyeing temp. °C Solubility in Na_2S Exhaustion Dyeing rate Solubility in water Remarks
				AFTERTREATMENT Acetic acid (1) Acetic acid and chrome (2) Acetic acid, chrome and copper (3) Peroxy compounds (4)
ISO 5 4–5 — — 4–5 3–4 4–5 5 3R — 4 4–5 3–4	ISO 5 4–5 — — 4–5 4 4–5 5 4G — 5 5 4	ISO 5 4–5 — — 4–5 4 4–5 5 4G — 5 5 4		**FASTNESS** Testing method Acid (organic) Alkali Cross dyeing, acid chrome Hot pressing Light ½–½ normal normal 2× normal Mercerising Milling Perspiration Washing moderate severe
				USAGE AND NOTES

C.I. Sulphur Brown 1—Leuco 3

C.I. Sulphur Brown	1	Leuco 1	Sol. 1	2	3	Leuco 3
C.I. CONSTITUTION NUMBER	53000	53000	53001	53060		
HUE	Brownish Olive→Yellowish Brown			Dull Yellowish Brown	Brown	
Artificial light (tungsten)	Slightly redder				Brighter	
REACTIONS ON CELLULOSE						
Alkaline sodium dithionite	Brown					
Sodium hypochlorite	Bleached					
H_2SO_4 conc.	Redder					
DYEING						
Method	1	3	6	1	1	3
Optimum dyeing temp. °C	90–95	90–95	90	80–95	90	90
Solubility in Na_2S				Good		
Exhaustion				Good		
Dyeing rate						Moderate–rapid
Solubility in water			Very good			
Remarks				Some brands require oxidation with peroxy compounds to obtain the correct hue		
AFTERTREATMENT						
Acetic acid (1)						
Acetic acid and chrome (2)	Yellower				Duller	
Acetic acid, chrome and copper (3)	Yellower			Yellower		
Peroxy compounds (4)	Slightly redder					

FASTNESS Testing method	AATCC	ISO	AATCC	ISO	ISO *	AATCC	ISO
Acid (organic)	4	4–5	—	4	—	—	3
Alkali	4	4–5	—	3–4	—	—	5
Cross dyeing, acid	—	4	—	4	—	—	3
chrome	—	—	—	—	—	—	—
Hot pressing	5	5	5	5	—	5	5
Light ⅓–½ normal	—	3	—	2	4	—	—
normal	3	3–4	4	3	4–5	5	6
2× normal	—	4–5	—	4	5–6	—	—
Mercerising	—	4G	—	—	—	—	—
Milling	—	—	—	—	—	—	—
Perspiration	—	4–5	—	—	—	—	4
Washing moderate	—	4–5	4	4–5	4	—	4
severe	3–4	4	—	3–4	4	3	—

*Aftertreatment 3

USAGE AND NOTES	This C.I. Generic Name is noteworthy as it includes products which closely resemble the first sulphur dye "Cachou de Laval"	Selected brands for direct prints	

C.I. Sulphur Brown	4	Leuco 4	Sol. 4	5	Leuco 5	Sol. 5	6
C.I. CONSTITUTION NUMBER	53210	53210	53211	53245	53245	53247	53335
HUE	Brownish Olive→Yellowish Brown			Dull Brown			Brown
Artificial light (tungsten)	Little redder						
REACTIONS ON CELLULOSE							
Alkaline sodium dithionite				Yellowish brown, returning to original on oxidation			
Sodium hypochlorite				Bleached			
H_2SO_4 conc.				Darker			
DYEING							
Method	1	3	6	1	3	6	1
Optimum dyeing temp. °C	90–95	90–95	90	70–90	90	70–90	
Solubility in Na_2S				Good			
Exhaustion				Moderate–good	Good		
Dyeing rate							
Solubility in water			Moderate				
Remarks				Aftertreatment 2 recommended for certain brands to develop the correct hue			
AFTERTREATMENT							
Acetic acid (1)							
Acetic acid and chrome (2)				Yellower			
Acetic acid, chrome and copper (3)				Yellower			
Peroxy compounds (4)							
FASTNESS							
Testing method	ISO	ISO *		ISO	ISO *		
Acid (organic)	4	5		3–4	4		
Alkali	3	2		3–4	3–4		
Cross dyeing, acid	3	4–5		3	4–5		
chrome	—	—		3	—		
Hot pressing	3	3		4	4–5		
Light ⅓–½ normal	2–3	3–4		3	4		
normal	3–4	5		4	5		
2× normal	4–5	6		5	6		
Mercerising	—	—		—	—		
Milling	4–5	5		3–4	—		
Perspiration	—	—		—	—		
Washing moderate	4	4–5		4	—		
severe	3–4	—		3	4		
	*Aftertreatment 3			*Aftertreatment 3			
USAGE AND NOTES	Selected brands for leather dyeing			Unsuitable for goods to be vulcanised Occasional use on oil tanned leather			

7	8	Leuco 8	Sol. 8	9	C.I. Sulphur Brown
53275	53020	53020	53021		C.I. CONSTITUTION NUMBER
Dull Reddish Brown	Brown			Yellowish Brown	**HUE** Artificial light (tungsten)
	Little change Pale yellow Yellower				**REACTIONS ON CELLULOSE** Alkaline sodium dithionite Sodium hypochlorite H_2SO_4 conc.
1 60–90	1 90–95 Good Moderate–good Moderate–rapid	3 90	6 90 Very good	1 70–90	**DYEING** Method Optimum dyeing temp. °C Solubility in Na_2S Exhaustion Dyeing rate Solubility in water
Certain brands in a dispersed form may be applied by method 6	Very similar in properties and application to C.I. Sulphur Brown 10 etc.			Acetic acid treatment recommended to develop the correct hue	Remarks
Redder	Redder, duller				**AFTERTREATMENT** Acetic acid (1) Acetic acid and chrome (2) Acetic acid, chrome and copper (3) Peroxy compounds (4)
ISO 4 4 3–4 — 4 4 5 5–6 — 4 — 4 3	ISO 3–4 3–4 5 4 5 2 3–4 4 — 5 — 5 4–5 *Aftertreatment 3	ISO * — — — — — 4 5 5–6 — — — — —	ISO 4 5 5 4–5 3–4 3 4 5 — 4–5 — 5 — *Aftertreatment 3	ISO * 5 5 4–5 4–5 3–4 4–5 5 6 — 5 — 5 —	**FASTNESS** Testing method Acid (organic) Alkali Cross dyeing, acid chrome Hot pressing Light ⅓–½ normal normal 2× normal Mercerising Milling Perspiration Washing moderate severe
	Selected brands, especially the solubilised types, used for leather dyeing				**USAGE AND NOTES**

C.I. Sulphur Brown 10—13

C.I. Sulphur Brown	10	Leuco 10	Sol. 10	11	Leuco 11	Sol. 11
C.I. CONSTITUTION NUMBER	53055	53055	53056			
HUE	Brown			Dull Brown		
Artificial light (tungsten)	Redder					
REACTIONS ON CELLULOSE						
Alkaline sodium dithionite	Little change					
Sodium hypochlorite	Pale yellow					
H_2SO_4 conc.	Yellower					
DYEING						
Method	1	3	6	1	3	6
Optimum dyeing temp. °C	70–95	70–95	90	90–95	90–95	80–90
Solubility in Na_2S	Good			Good		
Exhaustion	Moderate			Very good		
Dyeing rate						
Solubility in water			Very good			Moderate
Remarks	See also C.I. Sulphur Brown 8 etc.					
AFTERTREATMENT						
Acetic acid (1)						
Acetic acid and chrome (2)	Duller			Redder		
Acetic acid, chrome and copper (3)	Redder, duller			Slightly redder, slightly brighter		
Peroxy compounds (4)	Slightly brighter			Little change		

FASTNESS					
Testing method	AATCC	ISO	ISO *	ISO	ISO *
Acid (organic)	3–4	3	—	4	—
Alkali	5	4	4	4	—
Cross dyeing, acid	—	3	4–5	4–5	—
chrome	—	4–5	—	4–5	—
Hot pressing	5	4–5	4–5	4	—
Light $\frac{1}{3}$–$\frac{1}{2}$ normal	3	3	4–5	5	5–6
normal	4	3–4	5	5–6	6
2× normal	5	4	5	6–7	7
Mercerising	—	†D	—	†Y	—
Milling	4	4	4–5	4–5	—
Perspiration	—	5	—	4–5	—
Washing moderate	4–5	4	4–5	4	—
severe	—	4	4–5	3	—

*Aftertreatment 3 †Apparent increase in depth

*Aftertreatment 3 †Apparent increase in depth

USAGE AND NOTES	Selected brands for paper and oil-tanned leather

12	Leuco 12	Sol. 12	13	C.I. Sulphur Brown
53721	53721	53724		C.I. CONSTITUTION NUMBER
Reddish Brown Little yellower			Dull Reddish Brown	HUE Artificial light (tungsten)
Yellowish brown, returning to original on oxidation and acidification Bleached Dark brown				REACTIONS ON CELLULOSE Alkaline sodium dithionite Sodium hypochlorite H_2SO_4 conc.
1 50–90 Good Moderate Slow–moderate Slight Certain dispersed brands may be applied by method 6	3 50–90 Moderate	6 55–65 Very good	1 50–60 Formic acid may be used instead of acetic for after-treatment	DYEING Method Optimum dyeing temp. °C Solubility in Na_2S Exhaustion Dyeing rate Solubility in water Remarks
Recommended to develop the correct hue Yellower, duller, weaker Yellower, duller and weaker Slightly brighter, weaker				AFTERTREATMENT Acetic acid (1) Acetic acid and chrome (2) Acetic acid, chrome and copper (3) Peroxy compounds (4)
AATCC / ISO / ISO*			ISO / ISO*	FASTNESS
4–5 / 4 / 4–5			4 / 4	Testing method
2 / 2 / 3–4			4 / 4	Acid (organic)
— / 3 / 4			— / —	Alkali
— / 2–3 / 4			— / —	Cross dyeing, acid chrome
3–4 / 4 / 4			4 / 4	Hot pressing
— / 3 / 3			— / —	Light ⅓–½ normal
5 / 4 / 4–5			4 / 5	normal
— / 4–5 / 5			— / —	2× normal
— / 4–5Y / —			— / —	Mercerising
2 / 2–3 / —			— / —	Milling
— / 3 / —			— / —	Perspiration
— / 3–4 / 4			4 / 4–5	Washing moderate
3 / 2–3 / 3			— / —	severe
*Aftertreatment 3 †Apparent increase in depth			*Aftertreatment 3	
Occasional use of selected brands on oil-tanned leather Unsuitable for goods to be vulcanised				USAGE AND NOTES

C.I. Sulphur Brown	14	Leuco 14	Sol. 14	14:1
C.I. CONSTITUTION NUMBER	53246	53246	53248	
HUE	Dull Brown			Slightly different chemically from C.I. Sulphur Brown 14, but similar in properties and usage
Artificial light (tungsten)	Redder			
REACTIONS ON CELLULOSE				
Alkaline sodium dithionite	Yellowish brown, returning to original on oxidation			
Sodium hypochlorite	Bleached			
H_2SO_4 conc.	Darker			
DYEING				
Method	1	3	6	
Optimum dyeing temp. °C	70–90	70–90	70–90	
Solubility in Na_2S	Moderate			
Exhaustion	Moderate–good			
Dyeing rate			Slow–medium	
Solubility in water			Very good	
Remarks				
AFTERTREATMENT				
Acetic acid (1)	Recommended with some brands to develop the correct hue			
Acetic acid and chrome (2)				
Acetic acid, chrome and copper (3)	Yellower			
Peroxy compounds (4)				

FASTNESS Testing method	AATCC	ISO	ISO *
Acid (organic)	5	5	5
Alkali	4	4	4–5
Cross dyeing, acid	—	5	4–5
chrome	—	4–5	4–5
Hot pressing	4	4–5	4–5
Light $\frac{1}{3}$–$\frac{1}{2}$ normal	—	3	4–5
normal	5–6	4	5
2× normal	—	5	6
Mercerising	—	—	—
Milling	—	4	4–5
Perspiration	—	—	—
Washing moderate	3–4	4–5	5
severe	—	3–4	—

*Aftertreatment 3

USAGE AND NOTES	Selected brands occasionally used for dyeing paper and oil-tanned leather, and for direct prints on cellulose

15	Leuco 15	Sol. 15	15:1	16	Sol. 16	17	C.I. Sulphur Brown
53270	53270	53271		53285	53286		C.I. CONSTITUTION NUMBER
Dull Brown Slightly redder			Slightly different chemically from C.I. Sulphur Brown 15, but similar in properties and usage	Dull Brown Slightly redder		This C.I. Generic Name is no longer in use	HUE Artificial light (tungsten)
Orange brown Bleached Redder				Orange brown Bleached Violet			REACTIONS ON CELLULOSE Alkaline sodium dithionite Sodium hypochlorite H_2SO_4 conc.
1 70–90 Good Moderate–good	3 70–90	6 90 Good		1 70–90	6 70–90 Good		DYEING Method Optimum dyeing temp. °C Solubility in Na_2S Exhaustion Dyeing rate Solubility in water Remarks
Redder, brighter Redder, slightly weaker Brighter				Much duller Much duller Slightly redder			AFTERTREATMENT Acetic acid (1) Acetic acid and chrome (2) Acetic acid, chrome and copper (3) Peroxy compounds (4)
ISO 4–5 4 4 — 4–5 4 5–6 6 4 4 4–5 4 2–3 *Aftertreatment 3	ISO * 4–5 4 4 — 4 4–5 5–6 6 — 4–5 — 4–5 3–4			ISO 4 4 4 — 4–5 4–5 5–6 6–7 4–5 4 4–5 4–5 3 *Aftertreatment 3	ISO * 5 4–5 4 — 4–5 5–6 6 7 — 4 — 4–5 3–4		FASTNESS Testing method Acid (organic) Alkali Cross dyeing, acid chrome Hot pressing Light $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Mercerising Milling Perspiration Washing moderate severe
Occasional use for direct prints on cellulose							USAGE AND NOTES

C.I. Sulphur Brown	18	19	20	21	Leuco 21	Sol. 21	22
C.I. CONSTITUTION NUMBER		53115	53680	53065	53065	53066	53080
HUE	Brown	Yellowish Brown	Brown	Yellowish Brown			Dull Brown
Artificial light (tungsten)				Much redder			
REACTIONS ON CELLULOSE							
Alkaline sodium dithionite	Yellower			Yellowish orange			
Sodium hypochlorite	Bleached to pale yellow			Bleached			
H_2SO_4 conc.	Brown			Very slight change			
DYEING							
Method	1	1	1	1	3	6	1
Optimum dyeing temp. °C	90–95	70–90	90	90–95	90–95	90	90–95
Solubility in Na_2S	Good						
Exhaustion							
Dyeing rate							
Solubility in water						Good	
Remarks							
AFTERTREATMENT							
Acetic acid (1)		Recommended to develop correct hue					
Acetic acid and chrome (2)	Duller			Duller			
Acetic acid, chrome and copper (3)				Slightly redder, duller			
Peroxy compounds (4)				Greener			
FASTNESS							
Testing method	ISO / ISO*	ISO	AATCC / ISO	ISO / ISO*			ISO
Acid (organic)	3–4 / —	3–4	5 / 4	1–2 / 3			5
Alkali	3–4 / —	3–4	3 / 4	4 / 2–3			5
Cross dyeing, acid	4–5 / —	4	— / 4–5	4–5 / 3–4			—
chrome	3–4 / —	4	— / —	— / —			—
Hot pressing	5 / —	4	3–4 / 4–5	4–5 / 4–5			5
Light ⅓–½ normal	2 / 4	2–3	— / 4	3 / 5			—
normal	3 / 5	3–4	4 / 5	4 / 5			4–5
2× normal	4–5 / 5–6	4–5	— / 6	5 / 5–6			—
Mercerising	— / —	—	— / —	4–5 / —			—
Milling	4 / —	4	— / —	4 / 4			—
Perspiration	— / —	—	— / —	4–5 / —			—
Washing moderate	5 / —	4	— / 4–5	4 / 4			5
severe	3 / 4	3	— / 3–4	4 / 3–4			4
	*Aftertreatment 3			*Aftertreatment 3			
USAGE AND NOTES		Aftertreatment 3 improves light fastness	Aftertreatment 3 improves fastness to light and washing				

23	Leuco 23	24	25	26	Leuco 26	Sol. 26	C.I. Sulphur Brown
53075	53075	53025		53090	53090	53091	C.I. CONSTITUTION NUMBER
Brownish Olive		Yellowish Brown	Brownish Olive	Yellowish Brown			**HUE**
							Artificial light (tungsten)
		Little change					**REACTIONS ON CELLULOSE**
							Alkaline sodium dithionite
		Pale yellow					Sodium hypochlorite
							H_2SO_4 conc.
1	3	1	1	1	3	6	**DYEING** Method
70–90	70–90	90–95	90–95	90			Optimum dyeing temp. °C
		Good		Good			Solubility in Na_2S
		Good		Good			Exhaustion
							Dyeing rate
							Solubility in water
							Remarks
Recommended to develop the correct hue							**AFTERTREATMENT**
							Acetic acid (1)
		Redder, duller					Acetic acid and chrome (2)
		Redder, duller		Redder, duller			Acetic acid, chrome and copper (3)
		Little change					Peroxy compounds (4)
ISO	ISO *	ISO	ISO *	ISO	AATCC	ISO	**FASTNESS** Testing method
3–4	4	3	—	3–4	4	3	Acid (organic)
4	5	5	—	4–5	4	3–4	Alkali
3–4	4–5	5	—	—	—	4*	Cross dyeing, acid chrome
—	—	4	—	—	—	—	Hot pressing
4	4	5	—	5	5	4	
3	4	2	3	3–4	2	2*	Light $\frac{1}{3}$–$\frac{1}{2}$ normal
4	5	3–4	4–5	4–5	3	3*	normal
4–5	5–6	4	5–6	5	4	4*	2× normal
—	—	†RD	—	—	—	—	Mercerising
4–5	5	5	—	4–5	—	—	Milling
—	—	(Alk) 4–5	—	—	—	—	Perspiration
4–5	5	5	—	5	—	4–5*	Washing moderate
3–4	—	4–5	—	—	3	3*	severe
*Aftertreatment 3		*Aftertreatment 3 †Apparent increase in depth		*Aftertreatment 3 improves these fastnesses			
			Aftertreatment 3 improves the fastness to light	Selected brands for dyeing silk Occasional use on paper and for oil-tanned leather			**USAGE AND NOTES**

C.I. Sulphur Brown	27	28	Sol. 28	29	30
C.I. CONSTITUTION NUMBER					
HUE	This C.I. Generic Name is no longer in use	Brownish Olive		This C.I. Generic Name is no longer in use	Dull Brownish Olive
Artificial light (tungsten)					
REACTIONS ON CELLULOSE					
Alkaline sodium dithionite					
Sodium hypochlorite					
H_2SO_4 conc.					
DYEING					
Method		1	6		1
Optimum dyeing temp. °C		90–95	80–90		90
Solubility in Na_2S		Good			
Exhaustion		Good	Good		
Dyeing rate					
Solubility in water			Good		
Remarks					
AFTERTREATMENT					
Acetic acid (1)					
Acetic acid and chrome (2)		Slightly redder, slightly duller			
Acetic acid, chrome and copper (3)		Slightly redder			Slightly duller
Peroxy compounds (4)		Little change			
FASTNESS					
Testing method		ISO	ISO *		AATCC
Acid (organic)		5	5		4–5
Alkali		3	3		5
Cross dyeing, acid		3	3–4		—
chrome		2	3		—
Hot pressing		5	5		5
Light ⅓–½ normal		3–4	4–5		—
normal		5	6		4–5
2× normal		5–6	6		—
Mercerising		†G	—		—
Milling		3	4		4
Perspiration		4–5	—		—
Washing moderate		4	4–5		—
severe		3	3–4		4
		*Aftertreatment 3 †Apparent increase in depth			
USAGE AND NOTES					Aftertreatment 3 improves the fastness to light

31	Leuco 31	Sol. 31	32	33, 34	35	36	C.I. Sulphur Brown
53280	53280	53281			53035		C.I. CONSTITUTION NUMBER
Brown→Dull Brown			Dull Brown	These C.I. Generic Names are no longer in use	Brown	Yellowish Brown Yellower	**HUE** Artificial light (tungsten)
							REACTIONS ON CELLULOSE Alkaline sodium dithionite Sodium hypochlorite H_2SO_4 conc.
1 80–95	4 25–30	6 80–95	1 70–90		1 90–95 Slight Requires only small quantity of Na_2S for reduction	1 90 Brighter	**DYEING** Method Optimum dyeing temp. °C Solubility in Na_2S Exhaustion Dyeing rate Solubility in water Remarks
Yellower, brighter			Duller		Duller		**AFTERTREATMENT** Acetic acid (1) Acetic acid and chrome (2) Acetic acid, chrome and copper (3) Peroxy compounds (4)
ISO 4–5 4 4 — 4 — 6 — — — — 4 —			ISO ISO* 4 4–5 3–4 4 5 4 4 4 4 4 3 4–5 4 5 5 6 — — 4 4–5 — — 4–5 4–5 — — *Aftertreatment 3		ISO ISO* 3–4 — 4–5 — 3–4 — — — 5 — 2 3–4 3–4 5 4 5–6 — — 4–5 — — — 5 — 4–5 — *Aftertreatment 3	AATCC — — — — 5 — 4 — — — — 2 —	**FASTNESS** Testing method Acid (organic) Alkali Cross dyeing, acid chrome Hot pressing Light $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Mercerising Milling Perspiration Washing moderate severe
Leather dyeing					For dyeing chamois leather		**USAGE AND NOTES**

C.I. Sulphur Brown	37	Leuco 37	38	39, 40	41	42	43, Leuco 43
C.I. CONSTITUTION NUMBER			53100			53030	
HUE	Brown		Brown	These C.I. Generic Names are no longer in use	Brown	Brown	These C.I. Generic Names are no longer in use
Artificial light (tungsten)	Slightly yellower						
REACTIONS ON CELLULOSE							
Alkaline sodium dithionite							
Sodium hypochlorite							
H_2SO_4 conc.							
DYEING							
Method	1	3	1		1	1	
Optimum dyeing temp. °C	90	90	90		90	90–95	
Solubility in Na_2S							
Exhaustion							
Dyeing rate							
Solubility in water							
Remarks							
AFTERTREATMENT							
Acetic acid (1)							
Acetic acid and chrome (2)	Brighter						
Acetic acid, chrome and copper (3)						Redder, duller	
Peroxy compounds (4)							
FASTNESS							
Testing method	AATCC		ISO		ISO / ISO *	ISO / ISO *	
Acid (organic)	—		3–4		4–5 / —	4 / —	
Alkali	—		3–4		4–5 / —	4–5 / —	
Cross dyeing, acid	—		3–4		4–5 / —	4 / —	
chrome	—		—		— / —	— / —	
Hot pressing	5		—		4–5 / —	4–5 / —	
Light ⅛–½ normal	—		2		4 / 4–5	2–3 / 4	
normal	5		3		5 / 5–6	3 / 5	
2× normal	—		4		5–6 / 6	4 / 5–6	
Mercerising	—		—		— / —	— / —	
Milling	—		4		4–5 / —	5 / —	
Perspiration	—		—		— / —	— / —	
Washing moderate	3		4–5		4–5 / —	5 / 5	
severe	—		3–4		3 / —	4–5 / 4–5	
					*Aftertreatment 3	*Aftertreatment 3	
USAGE AND NOTES			Leather dyeing			For dyeing chamois leather	

44	Leuco 44	45	46	47	48	49	C.I. Sulphur Brown
			53015				C.I. CONSTITUTION NUMBER
Brown Brighter		Dull Brown Yellower	Yellowish Brown →Brown	This C.I. Generic Name is no longer in use	Yellowish Brown	This C.I. Generic Name is no longer in use	HUE Artificial light (tungsten)
							REACTIONS ON CELLULOSE Alkaline sodium dithionite Sodium hypochlorite H_2SO_4 conc.
1 90–95	3 90–95	1 90	1 90		1 90–95		DYEING Method Optimum dyeing temp. °C Solubility in Na_2S Exhaustion Dyeing rate Solubility in water Remarks
					Duller		AFTERTREATMENT Acetic acid (1) Acetic acid and chrome (2) Acetic acid, chrome and copper (3) Peroxy compounds (4)
AATCC 5 2 4 4 3 4 4–5 5 — 3 — 3 —		AATCC 3 3 5 5 4 4 4–5 5 — 4 — 3 —	ISO 3–4 4 4–5 — 4–5 3 4 4–5 — 3–4 — 4–5 3		ISO 4 4 4 4–5 4 2 2–3 4 — — — 4 3–4 *Aftertreatment 3	ISO * 4–5 4–5 4–5 4–5 4 4 4–5 5 — — — 5 4–5	FASTNESS Testing method Acid (organic) Alkali Cross dyeing, acid chrome Hot pressing Light $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Mercerising Milling Perspiration Washing moderate severe
Aftertreatment with $CuSO_4$ improves the fastness to light For dyeing leather and wood		Aftertreatment 3 improves the fastness to light and washing Leather, wood					USAGE AND NOTES

C.I. Sulphur Brown	50	51	Sol. 51	52	Sol. 52	53	53:1
C.I. CONSTITUTION NUMBER		53327	53328	53320	53321	53215	
HUE	Brown	Yellowish Brown		Brown		Brown	Slightly different chemically from C.I. Sulphur Brown 53, but similar in properties and usage
Artificial light (tungsten)	Yellower, brighter	Redder		Redder			
REACTIONS ON CELLULOSE							
Alkaline sodium dithionite		Reddish Brown		Reddish Brown			
Sodium hypochlorite		Bleached		Partially bleached			
H_2SO_4 conc.		Green					
DYEING							
Method	1	1	6	1	6	1	
Optimum dyeing temp. °C	90	90	90	90	90		
Solubility in Na_2S							
Exhaustion							
Dyeing rate							
Solubility in water			Very good		Very good		
Remarks							
AFTERTREATMENT							
Acetic acid (1)				Recommended to develop the correct hue			
Acetic acid and chrome (2)		Considerably duller		Slightly yellower			
Acetic acid, chrome and copper (3)		Considerably duller		Slightly yellower			
Peroxy compounds (4)		Little change		Slightly brighter			
FASTNESS							
Testing method	AATCC	ISO	ISO *	ISO	ISO *	ISO	ISO *
Acid (organic)	3	4–5	4–5	4–5	4–5	4	—
Alkali	1	4–5	4–5	4–5	4–5	4	—
Cross dyeing, acid	—	4	4	4	4	—	—
chrome	—	—	—	4	4	—	—
Hot pressing	3	4–5	4–5	5	5	4	—
Light ½–½ normal	4	6	6–7	4–5	5–6	—	—
normal	4–5	6–7	7	5–6	6	3	5
2× normal	5	7	7	6	6–7	—	—
Mercerising	—	5	—	4–5	—	—	—
Milling	4	4	4	4	4	3–4	—
Perspiration	—	4	—	4–5	—	—	—
Washing moderate	3	4	4	4	4–5	4	—
severe	—	4	4	3	4–5	—	—
		*Aftertreatment 3		*Aftertreatment 3		*Aftertreatment 3	
USAGE AND NOTES	Copper salts aftertreatment improves light fastness Leather and wood dyeing						

54	55	56	Sol. 56	57	58	C.I. Sulphur Brown
53070	53135	53722	53725			C.I. CONSTITUTION NUMBER
	Brownish Olive	Dull Reddish Brown Slightly yellower		Dull Yellowish Brown	Brown	**HUE** Artificial light (tungsten)
		Lighter and yellower, returning to original on oxidation Bleached Dark brown				**REACTIONS ON CELLULOSE** Alkaline sodium dithionite Sodium hypochlorite H_2SO_4 conc.
1	1 90–95	1 90–95 Good Good	6 80 Good	1 90–95	1 60–70	**DYEING** Method Optimum dyeing temp. °C Solubility in Na_2S Exhaustion Dyeing rate Solubility in water Remarks
		Sl. yellower, sl. duller Slightly yellower, duller Little change				**AFTERTREATMENT** Acetic acid (1) Acetic acid and chrome (2) Acetic acid, chrome and copper (3) Peroxy compounds (4)

ISO	ISO *	ISO	ISO *	ISO	ISO *	ISO	ISO *	ISO	ISO *	**FASTNESS** Testing method
5	5	5	5	4	—	4–5	—	4	—	Acid (organic)
4	4	4–5	5	4	—	3	—	5	—	Alkali
—	—	—	—	4–5	—	4–5	—	—	—	Cross dyeing, acid
—	—	—	—	3–4	—	—	—	—	—	chrome
4	3	5	4	4	—	5	—	5	—	Hot pressing
—	—	—	—	2–3	4	4–5	5–6	5–6	6–7	Light ⅓–½ normal
3	6	—	—	3–4	5	5–6	6–7	6	7	normal
—	—	4–5	5–6	5	6	6	6–7	6	7	2× normal
—	—	—	—	5Y	—	—	—	—	—	Mercerising
4	4	4–5	4–5	4	—	4–5	—	—	—	Milling
—	—	—	—	4–5	—	—	—	—	—	Perspiration
4	4–5	4–5	4–5	4–5	—	4	4–5	4–5	—	Washing moderate
—	—	—	—	3	—	3–4	4	—	—	severe
*Aftertreatment 3		*Aftertreatment 3		*Aftertreatment 3		*Aftertreatment 3		*Aftertreatment 3		
		Some brands contain copper and are not suitable for goods to be vulcanised								**USAGE AND NOTES**

C.I. Sulphur Brown	59	60	Sol. 60	61	62	63	64
C.I. CONSTITUTION NUMBER		53325	53326		53218	53272	
HUE	Brown	Dull Yellowish Brown		This C.I. Generic Name is no longer in use	Brownish Olive→ Yellowish Brown	Dull Brown	This C.I. Generic Name is no longer in use
Artificial light (tungsten)		Redder					
REACTIONS ON CELLULOSE							
Alkaline sodium dithionite	Unaffected	Reddish brown					
Sodium hypochlorite	Pale orange	Bleached					
H_2SO_4 conc.	Brown	Redder					
DYEING							
Method	1	1	6		1	1	
Optimum dyeing temp. °C	90–95	90	90				
Solubility in Na_2S							
Exhaustion							
Dyeing rate			Rapid				
Solubility in water			Very good				
Remarks			Control dyeing by temperature				
AFTERTREATMENT							
Acetic acid (1)							
Acetic acid and chrome (2)	Redder	Considerably duller					
Acetic acid, chrome and copper (3)	Redder, slightly duller	Considerably duller					
Peroxy compounds (4)	Slightly yellower	Little change					
FASTNESS							
Testing method	ISO / ISO *	ISO / ISO *					
Acid (organic)	3–4 / —	4–5 / 4–5					
Alkali	3–4 / —	4–5 / 4–5					
Cross dyeing, acid	4–5 / —	4–5 / 4–5					
chrome	3–4 / —	— / —					
Hot pressing	5 / —	5 / 4–5					
Light ⅓–½ normal	2–3 / 4	5 / 6					
normal	3–4 / 5	6 / 6–7					
2× normal	4–5 / 5–6	7 / 7					
Mercerising	5R / —	4–5 / —					
Milling	3–4 / —	4–5 / 4–5					
Perspiration	4–5 / —	4–5 / —					
Washing moderate	4–5 / —	4–5 / 4					
severe	3–4 / —	4 / 3–4					
	*Aftertreatment 3	*Aftertreatment 3					
USAGE AND NOTES							

65	66	67	68-73	74	Sol. 75	C.I. Sulphur Brown
						C.I. CONSTITUTION NUMBER
Dull Brown	Brownish Olive Slightly redder	Reddish Brown	These C.I. Generic Names are no longer in use	Yellowish Brown	Brown	HUE Artificial light (tungsten)
	Redder, returning to original on oxidation Orange–pale yellow					REACTIONS ON CELLULOSE Alkaline sodium dithionite Sodium hypochlorite H_2SO_4 conc.
1 90 Good	1 80–90 Good Very good	1 93 Very good Very good		1 90–100 Moderate	6	DYEING Method Optimum dyeing temp. °C Solubility in Na_2S Exhaustion Dyeing rate Solubility in water Remarks
Little change				Much redder Much yellower Much duller Much yellower, brighter		AFTERTREATMENT Acetic acid (1) Acetic acid and chrome (2) Acetic acid, chrome and copper (3) Peroxy compounds (4)
ISO / ISO *	ISO	AATCC		ISO / ISO *		FASTNESS Testing method
4–5 / —	3–4	4–5		4–5 / —		Acid (organic)
4–5 / —	5	3–4		— / —		Alkali
— / —	5	3–4		— / —		Cross dyeing, acid
— / —	—	3–4		— / —		chrome
4–5 / —	5	—		3 / —		Hot pressing
3–4 / 4	4	—		4–5 / 5–6		Light $\frac{1}{3}$–$\frac{1}{2}$ normal
4–5 / 5	5	5		5 / 6		normal
5 / 6	5–6	—		5–6 / 6–7		2× normal
— / —	5Y	—		5 / —		Mercerising
3–4 / —	4	3		— / —		Milling
— / —	4–5	—		Alk3–4 / —		Perspiration
4 / 5	4	—		3–4 / —		Washing moderate
3 / 4	3	3–4		3–4 / —		severe
*Aftertreatment 3				*Aftertreatment 3		
	Strong dyeings unsuitable for vulcanising					USAGE AND NOTES

C.I. Sulphur Brown	76	77	78	79	Sol. 80
C.I. CONSTITUTION NUMBER				53085	
HUE	Brownish Olive→ Yellowish Brown	Yellowish Brown	Yellowish Brown	Olive	Dull Yellowish Brown
Artificial light (tungsten)	Redder	Redder			Redder
REACTIONS ON CELLULOSE					
Alkaline sodium dithionite					
Sodium hypochlorite					
H_2SO_4 conc.					
DYEING					
Method		1	1	1	6
Optimum dyeing temp. °C	100	93	70–90	80–90	90
Solubility in Na_2S		Very good		Good	
Exhaustion	Good	Very good		Good	
Dyeing rate					
Solubility in water					Good
Remarks					
AFTERTREATMENT					
Acetic acid (1)	Recommended to develop correct hue				
Acetic acid and chrome (2)					
Acetic acid, chrome and copper (3)					
Peroxy compounds (4)					
FASTNESS					
Testing method	AATCC	AATCC / AATCC ■	ISO	ISO / ISO *	ISO / ISO ■
Acid (organic)	—	4–5 / —	3–4	2–3 / 3	— / —
Alkali	—	5 / —	3–4	3 / 4	3 / 3
Cross dyeing, acid	—	4 / —	4	3–4 / 5	4 / 4–5
chrome	—	4 / —	—	— / —	3–4 / 3–4
Hot pressing	4–5	— / —	—	3–4 / 4	4 / 3–4
Light ⅓–½ normal	—	— / —	—	2 / 4	3 / 6
normal	4–5	3 / 4–5	3–4	2–3 / 5	3–4 / 6–7
2× normal	—	— / —	—	3 / 5–6	4 / 6–7
Mercerising	—	— / —	—	— / —	— / —
Milling	—	— / —	4	5 / 5	— / —
Perspiration	—	— / —	—	— / —	— / —
Washing moderate	—	— / —	4	4–5 / 4–5	4–5 / 4–5
severe	4–5	4 / —	—	4 / 4	— / —
		*Aftertreatment 3		*Aftertreatment 3	*Aftertreatment 3
USAGE AND NOTES			Similar in constitution to C.I. 53115	Oil-tanned leather	

Leuco 81	Leuco 82	Sol. 83	84	85		C.I. Sulphur Brown
						C.I. CONSTITUTION NUMBER
Reddish Brown	Reddish Brown	Dull Reddish Brown	Reddish Brown No change	Brownish Olive		HUE Artificial light (tungsten)
						REACTIONS ON CELLULOSE Alkaline sodium dithionite Sodium hypochlorite H_2SO_4 conc.
3 93	3 93	6 80–95 Good	1 65 Good Aftertreatment with a copper containing cationic dye fixing agent is recommended	1 90		DYEING Method Optimum dyeing temp. °C Solubility in Na_2S Exhaustion Dyeing rate Solubility in water Remarks
		Yellower, duller Sl. yellower, brighter	Duller			AFTERTREATMENT Acetic acid (1) Acetic acid and chrome (2) Acetic acid, chrome and copper (3) Peroxy compounds (4)
AATCC	AATCC	ISO	ISO	ISO		FASTNESS Testing method
— — — — 5 4 — 5 — — — 4–5 —	— — — — 4–5 3–4 — 4–5 — — — 4–5 —	4–5 4 — — 5 4–5 5 5–6 — — — 3–4 —	4 3 4 2–3 5 3–4 4 5 — 4 — 4 3	— — — — 4–5 — 5 — — — 5 4–5 —		Acid (organic) Alkali Cross dyeing, acid chrome Hot pressing Light $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Mercerising Milling Perspiration Washing moderate severe
Leather dyeing Wood dyeing	Leather dyeing Wood dyeing	Also used on PVA fibres	Unsuitable for goods to be vulcanised			USAGE AND NOTES

C.I. Sulphur Black 1—2

C.I. Sulphur Black	1	Leuco 1	Sol. 1	2	Leuco 2	Sol. 2
C.I. CONSTITUTION NUMBER	53185	53185	53186	53195	53195	53196
HUE						
Artificial light (tungsten)	Greenish Black→Bluish Black			Bluish Black		
REACTIONS ON CELLULOSE						
Alkaline sodium dithionite	Yellow olive, returning to original on oxidation			Yellow olive, returning to original on oxidation		
Sodium hypochlorite	Bleached			Bleached		
H_2SO_4 conc.	Redder			Redder		
DYEING						
Method	1	3 and 4	6	1	3 and 4	6
Optimum dyeing temp. °C	80–95	80–95, occasionally cold	80–95	80–95	80–95, occasionally cold	80–95
Solubility in Na_2S	Very good			Very good		
Exhaustion	Good			Good		
Dyeing rate	Moderate			Moderate		
Solubility in water	Some brands slightly soluble		Very good			Very good
Remarks	The most important of the sulphur dyes. Widely used in all forms for producing fast blacks on cellulosic materials. Application by most methods, including pad/steam. Occasional use for direct prints on cellulose			Slightly redder in hue than C.I. Sulphur Black 1 but similar in application. Occasional use on silk with glucose and a protective colloid		
AFTERTREATMENT						
Acetic acid (1)	Slightly redder			Slightly redder		
Acetic acid and chrome (2)	Redder. Material must be well rinsed and should be left slightly alkaline‡			Redder. See C.I. Sulphur Black 1		
Acetic acid, chrome and copper (3)	Not recommended			Not recommended		
Peroxy compounds (4)	Bluer, brighter			Bluer, slightly brighter		

FASTNESS Testing method	AATCC	ISO	AATCC	ISO
Acid (organic)	5	4–5	5	5
Alkali	5	4–5	3	4
Cross dyeing, acid	—	4–5	—	4–5
chrome	—	4	—	4
Hot pressing	—	5	3	5
Light $\frac{1}{3}$–$\frac{1}{2}$ normal	—	5	—	5
normal	6–7	6–7	7–8	6–7
2× normal	—	7	—	7
Mercerising	—	†R	—	†R
Milling	4	4–5	4	5
Perspiration	—	5	—	5
Washing moderate	—	5	—	5
severe	4–5	4–5	4–5	4–5

†Apparent increase in depth

†Apparent increase in depth

USAGE AND NOTES

‡Sodium acetate in the final rinsing water after dyeing is useful to counteract the formation of acid which may give rise to tendering under unfavourable storage conditions
Selected brands for dyeing leather and paper

Suitable for goods to be vulcanised
Suitable for goods to be given anti-crease finishes
Leather, paper

C.I. Sulphur Black	3	4	5	Sol. 5	6	Leuco 6
C.I. CONSTITUTION NUMBER	53180	53631	53205	53206	53295	53295
HUE	Greenish Black	Bluish Black	Reddish Black		Bluish Black	
Artificial light (tungsten)						
REACTIONS ON CELLULOSE						
Alkaline sodium dithionite			Yellow olive, returning to original on oxidation			
Sodium hypochlorite			Bleached			
H_2SO_4 conc.			Redder			
DYEING						
Method	1	1	1	6	1*	3*
Optimum dyeing temp. °C	90–95		85–90	85–90	90	90
Solubility in Na_2S			Very good		Fair	
Exhaustion			Good		Good	
Dyeing rate					Moderate	
Solubility in water				Very good		
Remarks			See the notes under C.I. Sulphur Blacks 1 and 2 regarding aftertreatments which are also applicable		*Alternative application methods with NaOH and sodium dithionate alone or added to the Na_2S reduced dye liquors Selected brands for prints on cellulose	
AFTERTREATMENT						
Acetic acid (1)	Recommended to develop correct hue		Redder		Slightly duller	
Acetic acid and chrome (2)			Not recommended		Duller (not recommended)	
Acetic acid, chrome and copper (3)			Bluer, slightly brighter		Bluer, brighter	
Peroxy compounds (4)						
FASTNESS						
Testing method	ISO		AATCC	ISO	ISO	
Acid (organic)	3–4		3	5	4–5	Has slightly
Alkali	3–4		3	5	4–5	better fastness
Cross dyeing, acid	3–4		—	4	5	to chlorine
chrome	—		—	4	—	than most
Hot pressing	5		5	4–5	4–5	sulphur dyes
Light ⅓–½ normal	2–3		—	5	5	
normal	6		—	6–7	6–7	
2× normal	7		8	7	7	
Mercerising	—		—	—	—	
Milling	5		3	4–5	4–5	
Perspiration	—		—	—	—	
Washing moderate	5		5	5	5	
severe	4		—	4–5	—	
USAGE AND NOTES	Unsuitable for goods to be vulcanised				The addition of an EDTA sequestering agent to the dye-bath and washing water helps to prevent bronzy dyeings	

7	Sol. 7	8	9	Leuco 9	C.I. Sulphur Black
53300	53301	53520	53230	53230	C.I. CONSTITUTION NUMBER
Bluish Black		Grey	Bluish Black		HUE Artificial light (tungsten)
					REACTIONS ON CELLULOSE Alkaline sodium dithionite Sodium hypochlorite H_2SO_4 conc.
1* 90 Fair Good	6* 90	1 90	1 90–95	3 90–95	DYEING Method Optimum dyeing temp. °C Solubility in Na_2S Exhaustion Dyeing rate Solubility in water Remarks
*Alternative application method with NaOH and sodium dithionate alone or added to the Na_2S reduced dye liquor Selected brands for prints on cellulose					
Slightly duller Duller (not recommended) Bluer, brighter					AFTERTREATMENT Acetic acid (1) Acetic acid and chrome (2) Acetic acid, chrome and copper (3) Peroxy compounds (4)
ISO 4–5 4–5 4–5 — 4–5 — — 7 — — — 4–5 —	Has slightly better fastness to chlorine than most sulphur dyes	ISO 4 4–5 4 — 4 4–5 5–6 6 — 3–4 — 4–5 3	ISO 4–5 — 5 — 5 3 3–4 5–6 — — — 5 —		FASTNESS Testing method Acid (organic) Alkali Cross dyeing, acid chrome Hot pressing Light $\frac{1}{3}$–$\frac{1}{2}$ normal normal 2× normal Mercerising Milling Perspiration Washing moderate severe
See C.I. Sulphur Black 6 for other notes			Aftertreatment 3 slightly improves the fastness to light and acid		USAGE AND NOTES

C.I. Sulphur Black 10—17

C.I. Sulphur Black	10	Leuco 10	11	Leuco 11	Sol. 11	12	13-17
C.I. CONSTITUTION NUMBER	53190	53190	53290	53290	53291	53200	
HUE	Greenish Black		Bluish Black			Bluish Black	These C.I. Generic Names are no longer in use
Artificial light (tungsten)	Slightly Greener						
REACTIONS ON CELLULOSE							
Alkaline sodium dithionite						Yellow olive, returning to original on oxidation	
Sodium hypochlorite						Bleached	
H_2SO_4 conc.						Redder	
DYEING							
Method	1	3	1*	3 and 4*	6*	1	
Optimum dyeing temp. °C	90	90	90–100	30–100	90	90–95	
Solubility in Na_2S	Good		Fair			Very good	
Exhaustion	Good		Good			Good	
Dyeing rate			Moderate				
Solubility in water					Good		
Remarks	Greener than C.I. Sulphur Black 1		*Alternative application method with NaOH and sodium dithionate alone or added to the Na_2S reduced dye liquor Selected brands for direct prints on cotton				
AFTERTREATMENT							
Acetic acid (1)							
Acetic acid and chrome (2)			Slightly duller				
Acetic acid, chrome and copper (3)			Duller (not recommended)				
Peroxy compounds (4)			Bluer, brighter				
FASTNESS							
Testing method	AATCC		AATCC	ISO		ISO	
Acid (organic)	5		5	5	Has slightly	4	
Alkali	5		4	4–5	better fastness	4–5	
Cross dyeing, acid	—		—	5	to chlorine	4	
chrome	—		—	—	than most	3–4	
Hot pressing	5		5	5	sulphur dyes	4	
Light ⅛–½ normal	—		—	4–5		5	
normal	—		—	6–7		6–7	
2× normal	7		7–8	7		7	
Mercerising	—		—	5		—	
Milling	—		—	5		5	
Perspiration	—		—	5		—	
Washing moderate	—		—	5		5	
severe	3		4	4–5		4	
USAGE AND NOTES	Wood dyeing		The addition of an EDTA sequestering agent to the dyebath and washing water helps to prevent bronzy dyeings. Some brands used for dyeing nylon. The hue is redder than on cotton. Also for paper and leather			Leather dyeing	

CONDENSE SULPHUR DYES

This small class of dyes was established after a paper by Weston and Griffith in 1969 dealing with thiosulphate or thiocondensate dyes[1] drew attention to the application on cellulose of the sodium *S*-aryl thiosulphates of selected chromophores by methods which bore some resemblance to those used for Solubilised Sulphur dyes. In 1962 Schimmelschmidt, Hoffmann and Baier had reported the use of dyes which were sodium *S*-alkyl thiosulphates,[2] and these were previously included in the Ingrain dye section. With the introduction of the aryl types it was agreed to form this new class solely on the basis of their method of application, since their constitution and method of manufacture bear little resemblance to those of the Sulphur dyes.

Briefly, the dyes, which are water soluble and are non-substantive to cellulose, are applied to cellulose by padding and drying. The material is subsequently re-padded in an aqueous solution of an alkali sulphide, polysulphide or polythionate, which causes condensation between the divalent sulphur atoms in the dye molecules, giving an insoluble pigment within the fibre. Alternatively, thiourea may be used in the pad bath with the dye, and fixation achieved with steam or dry heat.

Because the Solubilised Sulphur dyes may also be applied by similar methods, it is possible to use them in conjunction with Condense Sulphur dyes. Conventional application methods for sulphur dyes are unsuitable for Condense Sulphur dyes and their chromophores are destroyed by reaction with sodium dithionite.

Certain of the dyes listed stain polyester and most are substantive to nylon, silk and wool in an acid bath.

[1] C. D. Weston & W. S. Griffith, 'Dykolite Dyestuffs for Cellulosic Fibres', *Textile Chemist & Colorist*, 1969, **1**, 462–477
[2] K. Schimmelschmidt, H. Hoffmann & E. Baier, 'Polykondensationsfarbstoffe', *Angew. Chem.*, 1962, **74**, 975–977

C.I. Condense Sulphur Yellow 1—3

C.I. Condense Sulphur Yellow	1	2	3
CHEMICAL CLASS **C.I. CONSTITUTION NUMBER**	Azo	Azo	Azo
HUE: Daylight Artificial light	Greenish Yellow Much redder	Bright Greenish Yellow Slightly brighter	Bright Greenish Yellow Slightly brighter
DYEING: CELLULOSE	(i) Pad, at 20–30°C, with aq. dye soln, urea, thickener and NaOH, followed by fixing with Na_2S soln, with or without intermediate drying (ii) Pad, at 20–30°C, with aq. dye soln, thickener, urea, Na_2CO_3 (or $NaHCO_3$) and thiourea, followed by drying and steam fixation at 100–105°C (iii) Pad, at 20–30°C, with aq. dye soln, thickener, urea and thiourea, followed by drying and dry heat fixation at 180°C Alginate thickeners are recommended to prevent migration during intermediate drying	(i) Pad, at 60–90°C, with aq. dye soln, together with urea, anti-migration assistant and Na_2SO_4 followed by drying and fixation with aq. polysulphides (ii) Pad, at 50–70°C, with aq. reduced dye soln, followed by drying and fixation with aq. polythionates (iii) Pad, with aq. dye soln, together with an active sulphur compound, e.g. thiourea May be used in conjunction with solubilised sulphur dyes or reduced sulphur dyes Normally for continuous piece dyeing	By the methods described for C.I. Condense Sulphur Yellow 2
OTHER FIBRES Dyeing		Nylon: from a weakly acid bath Wool: from a strongly acid bath Polyester/cotton blends: dyed almost solid with method (i) above Also used on leather	Polyester/cotton blends dyed almost solid with method (i) Nylon and wool dyed from acid bath Also used on leather
PRINTING		Cellulose: direct printing and steaming followed by fixation with aq. polysulphides May be used in combination with stabilised azoic dyes	By the method described for C.I. Condense Sulphur Yellow 2
FASTNESS PROPERTIES Method	ISO	AATCC	AATCC
Acid (organic)	5	—	—
Alkali	2–3R	—	—
Chlorinated pool water	—	4	4–5
Chlorine bleaching (mild)	1	—	—
Dry cleaning	5	4–5	5
Gas fading	5	5	5
Hot pressing, dry	4G	5	5
Light ⅛ normal	4–5	—	—
normal	—	3	3–4
2 × normal	—	—	—
Perspiration	4–5, 5	4, 5	5, 5
Washing moderate	—	4–5, 5	5, 5
severe	4–5, 5	4, 5	4–5, 5

C.I. Condense Sulphur Yellow 4—7

C.I. Condense Sulphur Yellow	4	5	6	7
CHEMICAL CLASS	Azo	Azo	Azo	Azo (metallised)
C.I. CONSTITUTION NUMBER				
HUE: Daylight	Bright Yellow	Bright Yellow	Bright Reddish Yellow	Reddish Yellow
Artificial light	Slightly brighter	Slightly brighter	Slightly brighter	Slightly duller
DYEING: CELLULOSE	By the methods described for C.I. Condense Sulphur Yellow 2	By the methods described for C.I. Condense Sulphur Yellow 2 Caustic soda must be used when dissolving the dye	By the methods described for C.I. Condense Sulphur Yellow 2 Padding should be above 60°C	By the methods described for C.I. Condense Sulphur Yellow 2
OTHER FIBRES Dyeing	Polyester/cotton blends dyed almost solid with method (i) Nylon and wool dyed from acid bath Also used on leather	Polyester/cotton blends: polyester reserved Nylon and wool dyed from acid bath Also used on leather	Polyester stained equal to cotton but poor light fastness Also used on leather	Polyester: slightly stained Nylon and wool from acid baths Also on leather
PRINTING	By the method described for C.I. Condense Sulphur Yellow 2	By the method described for C.I. Condense Sulphur Yellow 2	By the method described for C.I. Condense Sulphur Yellow 2	By the method described for C.I. Condense Sulphur Yellow 2
FASTNESS PROPERTIES Method	AATCC	AATCC	AATCC	AATCC
Acid (organic)	—	—	—	—
Alkali	—	—	—	—
Chlorinated pool water	4–5R	4	4–5D	4–5
Chlorine bleaching (mild)	—	—	—	—
Dry cleaning	4–5	5	5	5
Gas fading	5	4–5G	4–5R	4–5D
Hot pressing, dry	5	5	4–5	4–5
Light $\frac{1}{3}$ normal	—	—	—	—
normal	4–5	5	3–4	4–5
2 × normal	—	—	—	—
Perspiration	4R, 5	4–5R, 5	5	4–5G, 5
Washing moderate	4–5G, 5	4, 5	3–4, 5	3–4, 5
severe	3–4, 5	2–3, 5	2G, 4	3–4, 5

C.I. Condense Sulphur Orange 1—4

C.I. Condense Sulphur Orange	1	2	3	4
CHEMICAL CLASS	Azo (metallised)	Azo	Azo (metallised)	Azo (metallised)
C.I. CONSTITUTION NUMBER		18790		
HUE: Daylight	Dull Yellowish Orange	Bright Yellowish Orange	Reddish Orange	Dull Reddish Orange
Artificial light	Slightly brighter	Slightly brighter	Slightly yellower	Slightly yellower
DYEING: CELLULOSE	By the methods described for C.I. Condense Sulphur Yellow 2	By the methods described for C.I. Condense Sulphur Yellow 2	By the methods described for C.I. Condense Sulphur Yellow 2	By the methods described for C.I. Condense Sulphur Yellow 2
OTHER FIBRES Dyeing	Nylon: from a weakly acid bath Wool: from a strongly acid bath Polyester: medium stain Also on leather	Nylon: from a weakly acid bath Wool: from a strongly acid bath Polyester: dyed but very poor light fastness	Polyester: slight stain Nylon: from a weakly acid bath Wool: from a strongly acid bath Also on leather	Polyester: medium stain Nylon: from a weakly acid bath Wool: from a strongly acid bath Also on leather
PRINTING	By the method described for C.I. Condense Sulphur Yellow 2	By the method described for C.I. Condense Sulphur Yellow 2	By the method described for C.I. Condense Sulphur Yellow 2	By the method described for C.I. Condense Sulphur Yellow 2
FASTNESS PROPERTIES Method	AATCC	AATCC	AATCC	AATCC
Acid (organic)	—	—	—	—
Alkali	—	—	—	—
Chlorinated pool water	4–5	4D	5	4R
Chlorine bleaching (mild)	—	—	—	—
Dry cleaning	5	4Y	5	4–5R
Gas fading	5	4–5	5	4–5Y
Hot pressing, dry	4–5R	4–5	4–5	4R
Light $\frac{1}{3}$ normal	—	—	—	—
normal	4	3	3–4	5
2 × normal	—	—	—	—
Perspiration	5, 5	4–5D, 5	4–5Y, 5	5, 5
Washing moderate	4, 5	4–5D, 5	3–4, 5	3, 5
severe	3–4D, 5	2–3G, 5	3, 5	3, 5

C.I. Condense Sulphur Red	1	
CHEMICAL CLASS **C.I. CONSTITUTION NUMBER**	Azo (metallised)	
HUE: Daylight Artificial light	Dull Yellowish Red Slightly yellower	
DYEING: CELLULOSE	By the methods described for C.I. Condense Sulphur Yellow 2	
OTHER FIBRES Dyeing	Polyester/cotton blends: much bluer. Light stain on polyester Nylon and wool: from acid baths Also on leather	
PRINTING	By the method described for C.I. Condense Sulphur Yellow 2	
FASTNESS PROPERTIES Method	AATCC	
Acid (organic)	—	
Alkali	—	
Chlorinated pool water	5	
Chlorine bleaching (mild)	—	
Dry cleaning	5	
Gas fading	4–5D	
Hot pressing, dry	4–5	
Light $\frac{1}{3}$ normal	—	
normal	3–4	
2 × normal	—	
Perspiration	4–5B	
Washing moderate	3–4, 5	
severe	2, 5	

C.I. Condense Sulphur Blue 1—3

C.I. Condense Sulphur Blue	1	2	3
CHEMICAL CLASS	Phthalocyanine	Phthalocyanine	Phthalocyanine
C.I. CONSTITUTION NUMBER			
HUE: Daylight	Bright Blue	Bright Blue	Bright Greenish Blue
Artificial light	Brighter, much greener	Slightly greener	Greener
DYEING: CELLULOSE	By the methods described for C.I. Condense Sulphur Yellow 1 Shading may be done with suitable vat dyes	By the methods described for C.I. Condense Sulphur Yellow 1 Heat fixation temp. in method (iii) 140–180°C	By the methods described for C.I. Condense Sulphur Yellow 2 Poor washing fastness on unmercerised cotton
OTHER FIBRES Dyeing		Nylon: from an acetic acid bath Degummed silk: from a formic acid bath Fastness similar to cotton	Polyester: medium stain Nylon and silk: from acid bath Also on leather
PRINTING		Cellulose: direct prints with drying and fixing with Na_2S or with thiourea and fixation by neutral steaming Also on nylon, wool and silk	By the method described for C.I. Condense Sulphur Yellow 2

FASTNESS PROPERTIES				
Method	ISO	ISO (Cotton)	ISO (Nylon 6)	AATCC
Acid (organic)	5	—	—	—
Alkali	4–5	5	—	—
Chlorinated pool water	—	—	—	4D
Chlorine bleaching (mild)	4–5	4	4R	—
Dry cleaning	5	5	5	5
Gas fading	5	—	—	4G
Hot pressing, dry	3–4Y	4–5	4–5	5
Light $\frac{1}{3}$ normal	6–7	6–7	4	—
normal	6–7	—	5	4–5
2 × normal	—	—	—	—
Perspiration	5, 5	4–5, 5	4R, 5	4–5, 5
Washing moderate	—	4–5, 5	4, 4–5	3, 4
severe	4–5, 5	4–5, 5	—	2, 4

C.I. Condense Sulphur Green	1	
CHEMICAL CLASS **C.I. CONSTITUTION NUMBER**	Phthalocyanine	
HUE: Daylight Artificial light	Bright Green Yellower	
DYEING: CELLULOSE	By the methods described for C.I. Condense Sulphur Yellow 1	
OTHER FIBRES Dyeing		
PRINTING	As described for C.I. Condense Sulphur Blue 2	
FASTNESS PROPERTIES Method	ISO	
Acid (organic)	5	
Alkali	5	
Chlorinated pool water	—	
Chlorine bleaching (mild)	4–5	
Dry cleaning	4–5	
Gas fading	4–5	
Hot pressing, dry	4–5	
Light $\frac{1}{3}$ normal	6–7	
normal	—	
2 × normal	—	
Perspiration	4–5, 5	
Washing moderate	—	
severe	4–5, 5	

C.I. Condense Sulphur Black	1	
CHEMICAL CLASS **C.I. CONSTITUTION NUMBER**	Azo (metallised)	
HUE: Daylight Artificial light	Reddish Grey Redder	
DYEING: CELLULOSE	By the methods described for C.I. Condense Sulphur Yellow 2	
OTHER FIBRES Dyeing	Polyester/cotton blends: brighter and bluer. Medium stain on polyester Nylon and wool: from acid baths Also on leather	
PRINTING	As described for C.I. Condense Sulphur Yellow 2	
FASTNESS PROPERTIES Method	AATCC	
Acid (organic)	—	
Alkali	—	
Chlorinated pool water	4–5	
Chlorine bleaching (mild)	—	
Dry cleaning	3–4	
Gas fading	3B	
Hot pressing, dry	5	
Light $\frac{1}{3}$ normal	—	
normal	5–6	
2 × normal	—	
Perspiration	4–5, 5	
Washing moderate	4, 4–5	
severe	2–3B, 3	

VAT DYES

Historical

Few naturally occurring vat dyes are known. Indigo, obtained from the *Indigoferae*, was applied to textiles probably 5000 years before the introduction of commerical synthetic indigo and is one of the oldest dyestuffs known. Tyrian Purple, obtained from molluscs found on the shores of the eastern Mediterranean Sea, had for its effective agent the 6:6′ dibromoderivative of indigo and was a much later discovery; its use in Crete dates from about 1600 BC. The colour yields obtained were naturally small and costly so that materials coloured with this dye were reserved for royalty and persons of rank.

Bayer first synthesised indigo in 1879 but it was not until 1897 that the first commerical synthetic product was placed on the market.

In 1901 Bohn, attempting to prepare an anthraquinone analogue of indigo, obtained indanthrone, the first of the series of anthraquinonoid vat dyes, most of which possess greatly superior fastness properties compared to the previously known indigoid dyes.

A further major development took place in 1921 when Bader and Sunder succeeded in preparing a water-soluble leuco ester of indigo. This was placed on the market in 1922 under the name 'Indigosol O'. In 1924 a method of preparation direct from anthraquinone parent dyes by simultaneous reduction and esterification was patented by Jones, Wylam and Morton.

The synthetic vat dyes were nearly all originally sold as pastes in order to simplify the vatting operation but better methods of preparation enabled powders to be introduced and the physical condition of the modern powder brands has progressed step by step with the demands made by modern application methods such as continuous dyeing processes. In those cases where the dye, either in paste or powder form, is applied as a pigment with binder or is used for prepigmentation processes dyes of particularly fine particle size must be used.

Chemical

Vat dyes, with very few exceptions, fall into two clearly defined groups, indigoid and anthraquinonoid.

Included in the former are indigo, thioindigo and their derivatives while the latter include derivatives of anthraquinone as well as heterocyclic quinones. Characteristic of all these compounds is the ketonic group $>C=O$ which, on reduction, forms $>C—OH$. As leuco compounds are capable of forming water-soluble alkali metal salts the water-insoluble vat dyes may be brought into solution by reduction in alkaline liquor, in which form they exhibit affinity for textile fibres, subsequent oxidation re-forming the original insoluble dyestuff.

If the sodium leuco compounds are acidified acid leuco compounds can be prepared. Such compounds possess very much less affinity for the fibre and have been used to enable level dyeings to be obtained from dyestuffs which possess so great an affinity that, when applied by the normal process, they are difficult to apply evenly. The colours of these acid leuco compounds are often very different from those of the corresponding sodium compounds and these differences, and other colour changes based on chemical constitution, have been used for dyestuff identification on the fibre[1].

Water-soluble leuco esters of vat dyes are particularly suitable for the production of level pale shades or the colouring of materials difficult to penetrate. The original dye is regenerated by simultaneous hydrolysis and oxidation.

Tendering

Some vat dyes, especially among the yellows and oranges, possess the power of accelerating the degradation of cellulose (or silk) upon which they are dyed. Tendering is particularly liable to take place during dyeing when the dye is in a reduced condition and occurs to a lesser degree on exposure of the dyed fabric to sunlight and moisture. For this reason, dyes which accelerate the tendering of cellulose should be protected from direct sunlight during dyeing. Cellulose tendering has been shown to be due to a catalytic action of the dye during oxidation and reduction resulting in the formation of minute quantities of hydrogen peroxide which act on cellulose to form oxycellulose[2, 3, 4, 5].

Laboratory methods have been worked out to determine whether or not dyes will accelerate tendering and much work has been done to connect constitution and fading with cellulose degradation. In particular it has been shown that in some cases dyes containing pyridine or pyrimidine rings in their structures will not accelerate the tendering of cellulose[6].

Application – Dyeing

The conditions of application indicated throughout this section are those applicable to cellulosic fibres. Normally anthraquinone vat dyes are applied by one or more of three methods, referred to here as Methods 1, 2, and 3, corresponding to the hot, warm and cold dyeing methods in general use and approved by the S.D.C. Committee on the classification of vat dyes (*see* Appendix I to these notes). The preferred methods of application are indicated by an unbracketed number; alternative methods have the number enclosed in brackets.

Some hot-dyeing dyes require further additions of caustic soda to the dyebath and this is indicated by the code 1+. The dyeing method for indigoid dyes is designated Method 4.

Some indigoid dyes, and especially thioindigoid, may be applied by one of the methods used for anthraquinone dyes and this has been recorded when known.

In a few cases special application methods are used and these too are indicated.

When dyeing pale shades the speed of dyeing may be reduced by omitting electrolyte, adding a retarding agent and/or additional caustic soda and by temperature control.

Conversely, exhaustion may be increased by adding electrolyte or by reducing the alkalinity of the dyebath thus lowering the solubility of the leuco compound.

In those cases where oxidation after dyeing develops a black from a green, the dye is treated as a green and the development to a black is considered as an aftertreatment.

When the user is faced with the problem of colouring materials very difficult to penetrate the normal dyeing methods have to be modified, e.g. by acidifying the reduced dye to form the acid leuco compound which possesses very much less affinity for the fibre or, more commonly, by evenly impregnating the material with a very fine suspension of the unreduced dye and subsequently fixing it *in situ* by treatment with caustic soda and hydrosulphite (the pigment padding process)[7, 8].

The pigment padding process is the major basis for most continuous vat dyeing procedures e.g. pad steam[9]. Here the pigmented fabrics, preferably pre-dried, are passed through a cold padding liquor containing caustic soda and sodium hydrosulphite. Reduction and fixation are achieved by steaming at atmospheric pressure e.g. 30 seconds at 100–105°C. This is followed by continuous oxidation and soaping treatments as part of the continous sequence. Pre-pigmentation of loose fibres, yarn packages, knitgoods on the winch, and woven fabrics on the beam dyeing machine is a valuable aid to level dyeing in aqueous development processes.

Vat dyes may be applied to silk by methods similar to those used for cellulose although protective agents may be added to the dyebath in order to avoid damage to the fibre[10, 11].

As wool is so easily damaged by caustic alkali it is usual to prepare a stock vat using the minimum amount of caustic soda and to prepare the dyebath itself with ammonia, glue and hydrosulphite. After adding the stock vat to the dyebath the latter should react only faintly red to phenolphthalein. Should alkalinity develop later ammonium sulphate may be added to the dye liquor to reduce alkalinity to a minimum. The indigoid vat dyes, most of which may be applied by such methods, have been found to be suitable for wool[12] although anthraquinonoid vat dyes may also be used satisfactorily[13, 14].

Vat dyes of high molecular weight will not normally dye cellulose acetate with an acetyl content of over 34% unless the fibre has been swollen, when it becomes difficult to handle. Some vat dyes are subject to gas-fume fading unless the surface of the cellulose acetate has been partially saponified. In spite of these difficulties acetate has been dyed with vat dyes and a number of patents have been taken out covering the use of solvents and/or additions to the dyebath[15].

Selected vat dyes can be applied to polyester fibres by thermofixation, e.g. pigmented and dried goods are thermofixed at 200–220°C for 60 seconds. Vat dyes are frequently similarly applied together with disperse dyes by thermofixation or high temperature dyeing processes on polyester-cellulose fibre blends.

Application – Solubilised vats

The main use of solubilised vat dyes on cotton or rayon is for the production of level pale shades on piece goods, for yarns in package form and for materials difficult to penetrate. The water-soluble dye is applied from a neutral bath to cellulosic materials and from a weakly acid bath to wool or silk and, if the affinity is low, the colour may be applied by padding. The process is unsuitable for weighted silk as the weighting is removed in development. Dyeings are developed in a fresh bath in the presence of an oxidising agent such as sodium nitrite, sodium bichromate or ferric chloride together with sufficient sulphuric acid to hydrolyse the dyestuff on the fibre. For list of important Application Patents relating to solubilised vat dyes *see* Appendix II.

In the case of dyes sensitive to conditions of dyeing and oxidation milder development conditions are employed.

When exhaustion is good it is sometimes possible to use a one-bath process in which the nitrite is added to the dye liquor and development carried out in the same liquor by the addition of sulphuric acid to the exhausted dyebath.

Relatively recently the solubilised vat dyes have been commonly applied to polyester-cellulose blends to give pale shades of high fastness and shade solidity on both fibres. Subsequent to dyeing by the orthodox continuous or non-continuous methods used for cellulose alone, the developed, neutralised, soaped and dried material is given a short heat treatment (*circa* 30–60 seconds at 200°C) in order to fix the regenerated vat dye stain on the polyester fibre.

Application – Printing

A new era in textile printing opened with the introduction of vat dyes in spite of the difficulties associated with the early days when glucose in the presence of caustic soda was the only available reducing agent. The use of formaldehyde sulphoxylate with potassium carbonate alone or in conjunction with sodium carbonate greatly simplified the process while in recent years the use of thiourea dioxide as a reducing agent[16] has been suggested when printing acetate, wool or fibres likely to be damaged by alkali.

Two main processes of printing have been developed. In the first, the dyestuff, reducing agent and alkali are all incorporated in the printing paste, and, after printing, the material is dried and steamed. In the second process, which allows the printed but unreduced material to be stored indefinitely, the printing paste contains only the dyestuff and a thickener, the fabric being padded subsequently in a cold solution containing alkali, reducing agent and thickener, followed by steaming at 110–125°C for 40–50 seconds to reduce and fix the dye[17].

This process is the basis of the present day "flash age" method of print development.

When printing cellulose acetate with vat dyes it is necessary either to incorporate in the printing paste sufficient sodium or potassium carbonate to saponify the cellulose acetate at the point of contact or to lightly saponify the whole of the fabric by padding with, e.g., sodium carbonate and sodium chloride or glycerol, drying and steaming before printing. It is of interest to note that dyes of unsymmetrical indigoid structure are claimed to give the best result[18].

The solubilised vat dyes are normally printed with an oxidising agent with or without an acid splitting salt and development is brought about subsequently by steaming under neutral or acid conditions.

In addition to their application in direct printing, by the "all-in" or "flash-age" processes described above, the vat dyes and leuco esters may be employed, either alone or in conjunction with dyes of other classes, in a wide variety of discharge and resist styles.

The printing application data in this section refer to the use of the vat dyes and leuco esters in the six main fields of application. The titles used to describe these application fields, and the significance which has been attached to the titles for the purpose of recording the available information, are as follows:

Direct: The dye is suitable for use in direct printing on a white cellulose ground, by the "all-in" process.

Coloured Resist: The dye may be used as an illuminating colour in resist styles, i.e. as a head colour (under any ground).

White Resist: The dye when used as a ground may be resisted to give a good white (by any method).

Coloured Discharge: The dye may be used as an illuminating colour in discharge styles, i.e. as a head colour (on any ground).

White Discharge: The dye when used as a ground may be discharged to give a good white (by any method).

Flash Ageing: The dye is applicable by the two-stage process of printing, in which the printed fabric is padded with alkali and reducing agent and steamed in a flash-ager.

Aftertreatment

Subsequent to the oxidation of vat-dyed or vat-printed materials, or to the development of solubilised vat dyes, the material is advisedly soaped at the boil to remove any loose dye and to develop the true shade. During this treatment the dye becomes more crystalline and this may bring about changes in fastness, e.g. to light[19, 20, 21].

The fastness of the final shade may also be affected by the type of finish as, e.g. crease-resist, waterproofing, etc.

Presentation

The dyes in each hue group are arranged in numerical order according to the C.I. Generic Name. Where a dye is available both as a vat dye and the leuco ester, the vat dye appears first followed immediately by the solubilised form. Where a solubilised form exists without the corresponding parent dye, the solubilised form appears in the appropriate position according to its C.I. Generic Name.

The application and usage data are presented in tabular form. When the dye may be dyed by a variety of methods, the vatting and dyeing temperatures shown are those for the preferred method or methods only. Suitability or unsuitability for use in the various styles of printing is denoted by a ✓ or a × respectively.

The main fastness properties tabulated refer to dyeings on cellulose. The fastness properties on other substrates are included, where available, under "Textile Application other than Cotton". The three figures given for fastness to light refer to $\frac{1}{3}$–$\frac{1}{2}$ normal, normal and 2× normal depth dyeings. Where only one figure is given in the light fastness data this refers to the standard (normal) depth dyeing. When the dye is known to have a tendency to accelerate the degradation of cellulose this fact has been noted below the table of fastness properties.

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APPENDIX I

Extract from the Report of the S.D.C. Committee on the Dyeing Properties of Vat Dyes (*JSDC*, **66** (1950), 505)

The Committee was appointed by Council in 1948 with the object of standardising a series of tests which would provide the more essential information required about the dyeing properties of vat dyes.

The first and obvious requirement was a knowledge of the conditions which provided maximum colour yield. The Committee therefore surveyed the methods recommended by the principal dye manufacturers and found there was good agreement on the methods to be employed for the accepted classes of vat dyes.

Considering, in the first place, only the anthraquinonoid dyes, the Committee chose three dyeing methods based on those of the dye manufacturers, viz. the strong alkali, the weak alkali-high temperature, and the weak alkali-low temperature methods and adopted the three dyeing methods with minor changes, as Methods I, II and III (*referred to as A|Q1, A|Q2 and A|Q3 in the Colour Index, Second Edition, or as 1, 2 and 3 in the Colour Index, Third Edition*). Individual dye manufacturers throughout the world have adopted their own specific terminology in referring to these well-known methods of application.

The influence of salt and temperature on colour yield was also investigated. The influence of these factors was not great, and did not warrant additional tests, since the conditions obtaining in one of the prescribed dyeing tests usually coincided with the optimum conditions of salt and temperature. Higher temperatures were liable to effect changes in the hue of the dyeing.

The method which gave optimum colour yield having been determined, further information was required on the level-dyeing properties of a dye. The following tests were suggested for this purpose—

A Migration Test—A dyed hank and a white hank are entered together into a blank dyebath (i.e. omitting the dye) and treated together for say, 40 min. Comparison of the depths of dyeing on the two hanks then affords a measure of the migrating capacity of the dye.

A Strike-Levelling Test—A hank is entered into a dyebath and followed by a second hank after, say, 2 min. Dyeing is then continued for, say, 40 min, after which the depths of dyeing on the two hanks are compared.

The results obtained by both these tests were found to depend to a large extent on the depth of dyeing. A suitable depth for showing the differences between dyes was therefore chosen, and laid down in the specification.

The Strike-Levelling Test, which combines the effects of rate of dyeing and migration, was found to give results which corresponded well with the known dyeing behaviour of the dyes tested.

The Migration Test, which compares the intrinsic levelling capacities of dyes when tested under strictly comparable conditions, was considered to provide information on the ease with which an initially unlevel material could be levelled and especially on the influence of temperature on this property. This test was therefore prescribed to be carried out at two temperatures, a normal dyeing temperature and an elevated temperature, a note being made of any change in hue at the higher temperature. A few vat dyes may be partly destroyed at the higher temperature without this being obvious visually.

In order to detect any differences in experimental conditions Caledon Jade Green XN was chosen as a standard, since it had given the most reproducible results in interlaboratory comparisons. The behavior of this dye under the tests was therefore defined in terms of a number on the S.D.C. Grey Scale No. 2.

The Committee then considered the indigoid class of dyes. It was found that the tests prescribed for the anthraquinonoid dyes were also suitable for the indigoid dyes when modified to give more information on the influence of vatting temperature.

The above tests were designed to assess the dyeing properties of individual vat dyes. In practice, since the dyes will often be used in mixtures, some further information may be required. The Committee considered that a rate-of-dyeing test would provide the most useful information. It was decided that the test should consist of three dyeings carried out for 2, 5, and 40 min. respectively. Differences in rate of dyeing are manifest as differences of hue in the dyeings. This test is qualitative in nature, and will presumably be carried out under conditions approaching those obtaining in bulk.

The results of the application of the recommended tests to a range of vat dyes in common use are given in Table IV.

Tests were first made on the standard cotton yarn, but it was considered desirable to make comparative tests on mercerised cotton, viscose, and linen yarns. In general similar results were obtained on the different fibres, but there were a few differences, which may be important enough in practice to justify the separate testing of any particular material.

Recommended Methods of Test

1. materials used

Yarn—The tests are carried out on 40s/2 bleached American yarn having a medium doubling twist (about 15 t.p.in.) and having a fluidity value not exceeding 5 when measured in a standard cuprammonium solution.

Water—Water not exceeding a hardness of 5 parts of calcium carbonate per 100,000 (3·5° hardness) is employed throughout.

Dyes—Wherever possible powder brands are used. These are wetted with a little methylated spirit and then made into a suspension with water. Aliquot amounts are measured by pipette from the suspension as required. If the suspension is unsatisfactory, however, direct weighing of the dye for each dyebath is advisable. When paste brands are used, the same procedure is followed.

Indigoid dyes are pasted with Calsolene Oil HS (ICI) or a similar product at the rate of 0·5 ml per gram of dye. The oil may be diluted to a 25% solution if desired.

2. DYEING TESTS

(*a*) *Anthraquinonoid Dyes*

Depth of Shade—Dyeings are made in full shades equivalent in strength to the following—

Reference		Dyed by Method
1	20% Caledon Yellow 5GS Paste Fine ..	I
17	20% Caledon Brilliant Red 3BS Paste Fine ..	II
6	4% Cibanone Red 4B Powder	II
8	20% Caledon Brilliant Violet RS Paste Fine..	III
18	6% Caledon Brilliant Violet 3BS Paste Fine	I
13	20% Caledon Jade Green XNS Paste Fine ..	I
11	20% Caledon Blue RCS Paste Fine	I
19	20% Caledon Grey MS Paste Fine	I

Liquor Ratio—A liquor: goods ratio of 30: 1 is used.

Dyeing Method—Dyeings are carried out in tall beakers, and the hanks are worked on a bent rod so that the material is kept below the surface of the liquor. The vat is prepared with one-quarter of the volume of water required for the dyebath and approximately three-quarters of the stated quantities of caustic soda and sodium hydrosulphite. Vatting is allowed to proceed for 10 min. or until such time as a perfect solution is obtained.

The unused caustic soda and hydrosulphite are dissolved in the remaining water and then added to the vat. The hanks are thoroughly wetted in hot water only, cooled, squeezed so that they contain not more than their own weight of water, and entered into the dyebath. Where common salt is specified it should be in a finely ground condition and should be added to the dyebath in the solid state, 20 min. from the start of the dyeing. The hanks are turned for 1 min. in every 5 min.

The necessary details for vatting and dyeing by the three methods are given in Table I.

TABLE I

DETAILS FOR DYEING 10 g YARN WITH ANTHRAQUINONOID DYES

Method	I	II	III
Caustic soda (53°Tw, i.e. 300 g/litre solution), ml	4·5	2·0	2·0
Sodium hydrosulphite, g	1·0	1·0	1·0
Common salt, g	—	3·0	6·0
Vatting temperature, °C	60	50	40
(°F)	(140)	(120)	(105)
Dyeing temperature, °C	60	50	20
(°F)	(140)	(120)	(70)
Dyeing time, min.	40	40	40

Aftertreatment—The hanks, after removal from the dyebath, are treated as follows—

(i) Squeezed so that they contain about their own weight of liquor and allowed to oxidise completely in air.
(ii) Rinsed in cold running water.
(iii) Soured in sulphuric acid of concentration 0·5 ml of 160° Tw acid per litre for 5 min. at room temperature at a liquor ratio of 30:1.
(iv) Rinsed in cold running water.
(v) Treated in soap of concentration 2 g/litre for 10 min. at the boil at a liquor ratio of 30:1.
(vi) Rinsed, dried.

Assessment—The preferred dyeing method is that which gives the greatest colour yield; it is classed as Grade 5, and the results obtained by the other two methods are then given grades by assessing the differences from the preferred method in terms of the S.D.C. Grey Scale No. 2.

(*b*) *Indigoid Dyes*

Depth of Shade—Dyeings are made in full shades equivalent in strength to the following—

Reference		
21	20% Durindone Red 3BS Paste	Dyed by Method VI (vatted at 80°C)
22	5% Ciba Blue 2B Powder	Dyed by Method VI (vatted at 80°C)

Where, however, a dye is normally used for pale shades only, it is tested at such a depth, e.g.—

4	5% Durindone Pink FFS Paste	Dyed by Method VI (vatted at 80°C)

Liquor Ratio—A liquor: goods ratio of 30:1 is used.

Dyeing Method—The general procedure is the same as for the anthraquinonoid dyes, but vatting is carried out for 20 min. at two different temperatures. The necessary details for vatting and dyeing by the three methods are given in Table II.

TABLE II

DETAILS FOR DYEING 10 g YARN WITH INDIGOID DYES

Method	IV	V	VI
Caustic soda (53°Tw, i.e. 300 g/litre solution), ml	4·5	2·0	2·0
Sodium hydrosulphite, g	1·0	1·0	1·0
Common salt, g	—	3·0	6·0
Vatting temperature—			
(i) °C	50	50	50
(°F)	(120)	(120)	(120)
(ii) °C	80	80	80
(°F)	(175)	(175)	(175)
Dyeing temperature, °C	60	50	50
(°F)	(140)	(120)	(120)
Dyeing time, min.	40	40	40

Aftertreatment—As for the anthraquinonoid dyes.

Assessment—As for the anthraquinonoid dyes.

3. STRIKE-LEVELLING TEST

This test is designed to determine (*A*) the 'strike' and (*B*) the ability of partly dyed material to level. For this purpose two separate dyebaths are used.

The amount of dye to be used in each dyebath is equivalent to the following—

Reference		Dyed by Method
1	5% Caledon Yellow 5GS Paste Fine ..	I
6	1% Cibanone Red 4B Powder	II
20	5% Caledon Dark Brown 3RS Paste Fine ..	II
13	5% Caledon Jade Green XNS Paste Fine ..	I
8	5% Caledon Brilliant Violet RS Paste Fine	III
11	5% Caledon Blue RCS Paste Fine	I
10	20% Caledon Dark Blue BMS Paste Fine ..	I

The last dyeing is used as the standard depth for navy blues and blacks, but if it is required to assess these in lighter shades 5% Caledon Blue RCS is to be taken as the standard depth.

In the Strike-Levelling Test the quantities of caustic soda, sodium hydrosulphite, and water and also the vatting temperature are those which are used in the preferred dyeing method. The dyeing temperature is the same as in the preferred method, but Method III dyes are also tested at 50°C (120°F). No salt is added in any method.

(*A*) *Determination of Strike*—A 5-g hank is entered into the dyebath, and is turned steadily and continuously. After 2 min. a second 5-g hank is entered, and both are turned in the same way. After a further 3 min. (i.e. after 5 min. from the start) both hanks are removed from the dyebath and aftertreated as described under DYEING TESTS. The difference in depth of shade between the two hanks is then assessed in terms of the S.D.C. Grey Scale No. 2.

(*B*) *Determination of Levelling*—A 5-g hank is entered into the dyebath, and is turned steadily and continuously. After 2 min. a second 5-g hank is entered, and both are turned in the same way for 3 min. Thereafter the hanks are turned for 1 min. in every 5 min. After a further 35 min. (i.e. after 40 min. from the start) both hanks are removed from the dyebath and aftertreated as described under DYEING TESTS. The difference in depth of shade between the two hanks is then assessed in terms of the S.D.C. Grey Scale No. 2.

Standard for Strike-Levelling Test—In order to assist in obtaining the correct conditions for carrying out this test, a preliminary test is made using 5% Caledon Jade Green XNS Paste Fine applied by Method I on the standard 40s/2 bleached cotton yarn. This dye should give the following results when assessed on the S.D.C. Grey Scale No. 2—

Strike ... ... Grade 2–3
Levelling ... ... Grade 3–4

Note—The influence of temperature on the degree of levelling may be determined by carrying out the test at different temperatures. The test may also be used for studying the influence of other aids to levelling, e.g. restraining agents.

4. MIGRATION TEST

This test is designed to determine the ease with which the dye on a dyed material can be transferred to undyed material.

The amount of dye to be used in making the dyeing is the same as prescribed for the Strike-Levelling Test.

The test is carried out at the two temperatures given in Table III.

TABLE III

TEMPERATURES OF MIGRATION TEST

Dyeing Method		Temperatures °C	(°F)	°C	(°F)
I	...	50	(120)	80	(175)
II	...	50	(120)	80	(175)
III	...	20	(70)	50	(120)
IV	...	50	(120)	80	(175)
V	...	50	(120)	80	(175)
VI	...	50	(120)	80	(175)

No salt is added in any method.

Determination of Migration—Two 5-g hanks are dyed by the preferred dyeing method as described under DYEING TESTS and aftertreated with the exception of soaping. One of the dyed hanks and a 5-g undyed hank are placed in a bath containing the same amounts of caustic soda, sodium hydrosulphite, and water as are used in dyeing a 10-g hank by the preferred dyeing method. The hanks are treated in the 'blank' bath for 40 min., being turned steadily for the first 5 min. and thereafter for 1 min. in every 5 min. They are then removed from the bath and aftertreated as described under DYEING TESTS, the second of the original two dyed hanks being included at the soaping stage. The difference in depth of shade between the two hanks which have been treated in the blank bath is then assessed in terms of the scale of contrasts given by the S.D.C. Grey Scale No. 2. Any change in hue of the dyed hank treated at 80°C is noted.

Standard for Migration Test—In order to assist in obtaining the correct conditions for carrying out this test, a preliminary test is made using 5% Caledon Jade Green XNS Paste Fine applied by Method I on the standard 40s/2 bleached cotton yarn. This dye should give the following results when assessed on the S.D.C. Grey Scale No. 2—

At 50°C ... ... Grade 1
At 80°C ... ... Grade 3–4

5. RATE-OF-DYEING TEST FOR MIXTURES

This test is designed to determine the behaviour of a mixture of vat dyes when used to produce a compound shade. It may be applied at any depth of shade and by any dyeing method, with or without the addition of common salt or restraining agents. Normally the conditions of testing are those described under DYEING TESTS, but the dyer will obtain the most useful information by carrying out this test under conditions as near as possible to those under which the mixture will be used in practice.

Method of Testing—The mixture of dyes is dyed at the selected strength in separate dyebaths for (*a*) 2 min., (*b*) 5 min., (*c*) 40 min.

Unless decided otherwise, the conditions of dyeing and aftertreatment are the same as for DYEING TESTS.

Assessment—This is a qualitative test only. If the three dyeings obtained are of the same hue, then the mixture dyes satisfactorily under the conditions of the test; but if there is a large difference in hue between the three dyeings, then the mixture is unsatisfactory.

TABLE IV

APPLICATION OF TESTS TO CERTAIN DYES

(The figure corresponding to the optimum dyeing method for each dye is printed in **bold type**)

Reference		C.I. 2nd Edn. Part II	Dyeing Method I	II	III	IV	V	VI	Strike 25°C	50°C	60°C	Levelling 20°C	50°C	60°C	Migration 20°C	50°C	80°C
			COTTON (40s/2 BLEACHED AMERICAN)														
1	Caledon Yellow 5G (ICI)	67300	**5**	5	5	–	–	–	–	–	4–5	–	–	4–5	–	1	4–5
2	Caledon Gold Orange 3G (ICI)	69025	4	**5**	4–5	–	–	–	–	4–5	–	–	5	–	–	2	3–4
3	Cibanone Orange 6R (Ciba)	65705	4–5	**5**	3–4	–	–	–	–	3–4	–	–	4–5	–	–	1	4
4	Durindone Pink FF (ICI)*	73360	–	–	–	**5**	**5**	**5**	–	3	–	–	4	–	–	3	4–5
5	Caledon Red BN (ICI)	68000	3	4	**5**	–	–	–	3–4	4–5	–	5	–	–	1	4	–
6	Cibanone Red 4B (Ciba)	65805	4–5	**5**	4	–	–	–	–	3–4	–	–	5	–	–	2	4
7	Caledon Brilliant Purple 4R (ICI)	60010	**5**	5	4	–	–	–	–	–	2–3	–	–	2–3	–	1	2
8	Caledon Brilliant Violet R (ICI)	63365	3	4	**5**	–	–	–	4	4	–	5	5	–	1	4	–
9	Caledon Violet XBN (ICI)	68700	4–5	**5**	5	–	–	–	–	3–4	–	–	5	–	–	2	3–4
10	Caledon Dark Blue BM (ICI)	59800	**5**	3–4	3–4	–	–	–	–	–	4	–	–	4–5	–	1	2
11	Caledon Blue RC (ICI)	69825	**5**	4	4–5	–	–	–	–	–	3–4	–	–	4–5	–	1	2–3
12	Ciba Blue 2RH (Ciba)†	53630	–	–	–	4–5	**5**	4–5	–	3	–	–	5	–	–	2	4
13	Caledon Jade Green XN (ICI)	59825	**5**	5	5	–	–	–	–	–	2–3	–	–	3–4	–	1	3–4
14	Caledon Olive Green B (ICI)	69580	4–5	**5**	3	–	–	–	–	3	–	–	4	–	–	1	4–5
15	Caledon Olive R (ICI)	69005	4	**5**	4	–	–	–	–	4	–	–	4–5	–	–	2	4
16	Caledon Brown R (ICI)	69015	4–5	**5**	4–5	–	–	–	–	3–4	–	–	5	–	–	1	2
			MERCERISED COTTON (40s/2 BLEACHED EGYPTIAN)														
2	Caledon Gold Orange 3G (ICI)	69025	4–5	4–5	**5**	–	–	–	4	4	–	4	4–5	–	1	1	–
5	Caledon Red BN (ICI)	68000	3	4	**5**	–	–	–	5	3–4	–	4–5	4–5	–	1	4	–
7	Caledon Brilliant Purple 4R (ICI)	60010	**5**	5	5	–	–	–	–	–	2	–	–	4	–	1	2
8	Caledon Brilliant Violet R (ICI)	63365	4	4–5	**5**	–	–	–	3	4	–	5	5	–	1	4–5	–
10	Caledon Dark Blue BM (ICI)	59800	**5**	4–5	4	–	–	–	–	–	2	–	–	3	–	1	1
13	Caledon Jade Green XN (ICI)	59825	**5**	4–5	4	–	–	–	–	–	3	–	–	3–4	–	1	4
			LINEN (35s BLEACHED LINE YARN)														
2	Caledon Gold Orange 3G (ICI)	69025	4	**5**	4–5	–	–	–	–	3	–	–	5	–	–	1–2	3
4	Durindone Pink FF (ICI)	73360	–	–	–	5	5	**5**	–	3	–	–	4	–	–	1	3
6	Cibanone Red 4B (Ciba)	65805	4–5	4–5	**5**	–	–	–	1	4	–	4–5	4–5	–	2	3	–
11	Caledon Blue RC (ICI)	69825	**5**	4	4	–	–	–	–	–	3	–	–	4–5	–	1	2
13	Caledon Jade Green XN (ICI)	59825	4–5	**5**	4	–	–	–	–	3	–	–	4	–	–	1	3
			VISCOSE RAYON (150/27 BRIGHT)														
2	Caledon Gold Orange 3G (ICI)	69025	4–5	**5**	4	–	–	–	–	4	–	–	5	–	–	2	3–4
6	Cibanone Red 4B (Ciba)	65805	**5**	3–4	2	–	–	–	–	–	4	–	–	5	–	1	3
5	Caledon Red BN (ICI)	68000	5	5	**5**	–	–	–	3–4	3	–	4–5	4–5	–	1	2–3	–
8	Caledon Brilliant Violet R (ICI)	63365	4	**5**	4	–	–	–	–	3	–	–	5	–	–	2–3	5
11	Caledon Blue RC (ICI)	69825	**5**	5	3	–	–	–	–	–	3	–	–	3	–	1	2–3
13	Caledon Jade Green XN (ICI)	59825	**5**	5	5	–	–	–	–	–	2–3	–	–	3	–	1	3–4

*Vatted at 80°C

†Vatted at 50°C

REFERENCES

	2nd Edition *Part II*	*Part I*	*1st Edition*		*2nd Edition* *Part II*	*Part I*	*1st Edition*
1.	67300	C.I. Vat Yellow 2	—	*12.*	53630	C.I. Vat Blue 43	—
2.	69025	C.I. Vat Orange 15	—	*13.*	59825	C.I. Vat Green 1	1101
3.	65705	C.I. Vat Orange 18	—	*14.*	69500	C.I. Vat Green 3	—
4.	73360	C.I. Vat Red 1	—	*15.*	69005	C.I. Vat Black 27	1150
5.	68000	C.I. Vat Red 35	1162	*16.*	69015	C.I. Vat Brown 3	1511
6.	65805	C.I. Vat Red 24	—	*17.*	67000	C.I. Vat Red 10	—
7.	60010	C.I. Vat Violet 1	—	*18.*	60005	C.I. Vat Violet 9	—
8.	63365	C.I. Vat Violet 17	1135	*19.*	71000	C.I. Vat Black 8	—
9.	68700	C.I. Vat Violet 13	—	*20.*	70800	C.I. Vat Brown 1	—
10.	59800	C.I. Vat Blue 20	—	*21.*	73385	C.I. Vat Violet 2	—
11.	69825	C.I. Vat Blue 6	1114	*22.*	73065	C.I. Vat Blue 5	

APPENDIX II

APPLICATION PATENTS (SOLUBILISED VAT DYES)

Durand and Huguenin, *BP*202630, 202632, 203681, 218649, 220964, 298088, 427058, 503699; *USP*2029351; *FP*769171, 835854; *Sw P* 102280, 102540, 102912, 103138, 103139, 106458, 106459, 107336, 107337, 110419, 111279, 111280, 111281, 111282, 111719, 115236, 115239, 116278, 116279, 116280, 116281, 116282, 116283; *GP*410972, 504076, 679767. I.G., *BP*337846, 431072, 452018. Scottish Dyes, *BP*359889, 363668, 363669. I.C.I., *BP*421066, 633536. Stewart, *BP*633634.

C.I. Vat Yellow	1	Solubilised 1	2	Solubilised 2
C.I. Constitution Number or Chemical Class	70600	70601	67300	67301
Hue Artificial Light	Reddish Yellow Redder		Greenish Yellow Redder	
Reaction with conc. sulphuric acid (on cellulose)	Reddish Yellow		Greenish Yellow	
DYEING				
Method	1 (2)		1 (2, 3)	
Vatting Temp. °C	50–60		55	
Dyeing Temp. °C	50–60		50–60	
Leuco Alkaline	Blue		Violet	
Acid	Green		Dull Orange	
Substantivity	High	High	High	High
Levelling	Good		Good	
Remarks	When dyeing by Method 2, increase NaOH by 15% Accelerate oxidation with acid bichromate. Avoid strongly alkaline soap solutions. Dead cotton covered moderately well	Apply from a weakly alkaline bath Develop with nitrite	SDC report on strike, levelling and migration, see *JSDC*, **66** (1950) 505 Dead cotton covered moderately well	Dye neutral adding Glauber's salt and sodium nitrite Develop with sulphuric acid at 30°C
PRINTING				
Direct	✓	✓	✓	✓
Coloured Resist	✓	✓*	✓	—
White Resist	—	✓*	✓	—
Coloured Discharge	✓	×	✓	×
White Discharge	×	×	✓*	×
Flash Ageing	✓	×	✓	×
Remarks	May be applied in strongly alkaline pastes. Oxidise with peroxide, as bichromate causes dulling	*With an addition of dimethyl phenyl benzyl ammonium chloride	Oxidise with peroxide as bichromate causes dulling *Pale dyeing only	Develop with chlorate
FASTNESS				
Testing Method	AATCC	ISO	AATCC	ISO
Cross Dyeing	5	5	5	5
Hot Pressing	3	2	5	4
Hypochlorite	5	5	5	5
Light	—, 2–3, —*	5–6, 6, 6–7	3–4, 4, 4	3–4, 3–4, 4
Mercerising	4	5	4–5	4–5
Peroxide Bleach	4–5	4–5	5	5
Soda Boil	4	3–4	4	5
Soda Boil (Hypochlorite)	—	4	—	5
Washing Alteration	—	5	—	5
Staining	—	5	—	5
Remarks	*Photochromic: Returns to original hue in air or on mild soaping		Accelerates tendering on exposure to light	
TEXTILE APPLICATION OTHER THAN COTTON	VISCOSE: For data on strike, rate of diffusion and time of half-dyeing see *JSDC*, **55** (1939) 481. Barry viscose covered moderately well	SILK: Neutral or weakly alkaline bath at 60–80°C adding NaCl. Develop with ammonium persulphate	VISCOSE: For data on strike, rate of diffusion and time of half-dyeing see *JSDC*, **55** (1939) 481 SILK: Substantivity, high; levelling, good WOOL: Suitable	SILK: Apply neutral exhaust with acetic acid WOOL: As for silk
NON-TEXTILE USAGE	See C.I. Pigment Yellow 112		PAPER: Stock colouration	

C.I. Vat Yellow	3	Solubilised 3	4	4:1	Solubilised 4
C.I. Constitution Number or Chemical Class	61725	61726	59100		59101
Hue Artificial Light	Yellow Redder		Reddish Yellow Redder and slightly brighter		
Reaction with conc. sulphuric acid (on cellulose)	Dull Yellow		Reddish Violet		
DYEING Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks	3 (2) 50 (Short liquor) 25 Bordeaux Reddish Yellow Moderate Good Dead cotton covered moderately well. Sensitive to excess NaOH, part of which can be replaced by Na_2CO_3 Oxidise before rinsing	Poor Dye neutral adding Na_2SO_4. Develop nitrite Applicable by the one-bath method	3 (2) 50 (Short liquor) 25 Bordeaux Golden Yellow High Good Dead cotton covered moderately well	USAGE/PROPERTIES: Similar to C.I. Vat Yellow 4 Slightly different chemically	Moderate Neutral or weakly alkaline bath at 20–30°C Develop nitrite (hot or cold). Suitable for one-bath method (develop at 30°C)
PRINTING Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks	✓* ✓ ✓ ✓ — — *Only of moderate interest. For use either in strongly or weakly alkaline printing pastes	✓ ✓ ✓ × ✓ × Develop with chlorate, nitrite or bichromate	✓ ✓ ✓ ✓ ✓ — May be applied in strongly alkaline print pastes		✓ ✓ ✓ × ✓ × Develop with chlorate, nitrite, bichromate or copper sulphate
FASTNESS Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks	AATCC / ISO 4–5 / 5 5 / 5 5 / 5 4–5, 5, 5–6 / 5–6, 6, 6 4 / 4–5 4 / 5 4 / 4–5 — / 4–5 — / 5 — / 5 Accelerates tendering on exposure to light		AATCC / ISO 5 / 4–5 5 / 4–5 5 / 4–5 4, 4–5, 5 / 5, 5–6, 6 5 / 5 4 / 4–5 3–4 / 2–3 Unsuitable / Unsuitable — / 3–4 — / 4 Accelerates tendering on exposure to light		
TEXTILE APPLICATION OTHER THAN COTTON	VISCOSE: For data on strike, rate of diffusion and time of half-dyeing, see *JSDC*, **55** (1939) 481 SILK: Substantivity, high; levelling, good WOOL: Suitable	SILK: Dye weakly acid adding sodium sulphoxylate-formaldehyde Develop bichromate WOOL: Neutral bath, exhaust with acetic acid. Develop bichromate	SILK: Suitable FASTNESS SILK (ISO): Light 6 Peroxide 5 WOOL: Suitable FASTNESS WOOL (ISO): Light 7 Washing 4		SILK: Dye weakly acid adding sodium sulphoxylate-formaldehyde Develop bichromate WOOL: Dye weakly acid adding ammonium sulphate. Develop bichromate using extra bichromate
NON-TEXTILE USAGE	Soap		PAPER: Stock colouration		

5	Solubilised 5	Solubilised 6	Solubilised 7	C.I. Vat Yellow
56005	56006	Anthraquinone	60531	C.I. Constitution Number or Chemical Class
Dull Yellow→Dull Brownish Yellow Redder and brighter		Yellow	Bright Greenish Yellow Redder	Hue Artificial Light
Reddish Violet			Yellow	Reaction with conc. sulphuric acid (on cellulose)
4 75 55 Pale Yellow Colourless High Very good	Low Neutral or weakly alkaline bath at 20–30°C Develop with nitrite (hot) Soap at 40–50°C	Moderate From a neutral or weakly alkaline bath Develop with nitrite (hot or cold)	Low Dye neutral or weakly alkaline at 20–30°C Substantivity improved by adding NaCl Develop with nitrite (hot or cold)	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
× × × × ✓ —	✓ ✓ ✓ × ✓ × Develop with chlorate, nitrite or bichromate	✓ ✓ ✓ × ✓ × Develop with chlorate or nitrite	✓ ✓ ✓ × ✓ × Develop with chlorate, nitrite or bichromate	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
AATCC — 5 3 3–4 2 3 3–4 — 5 —	ISO — 5 2–3 3, 4, 5 — — 3 — 4 —	ISO — — 5 3–4, 4–5, — — — — — 4–5 —	ISO — — 5 4, 5, 6 — — 4 Suitable 4 —	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
WOOL: Substantivity, high; levelling, good FASTNESS WOOL (ISO): Light 5–6 Peroxide 5 SILK: Suitable FASTNESS SILK (ISO): Light 4 Peroxide 4	WOOL: Dye weakly acid adding sodium sulphoxylate-formaldehyde and ammonium sulphate High substantivity Develop bichromate SILK: Dye weakly acid adding sodium sulphoxylate-formaldehyde High substantivity Develop bichromate	SILK: Dye weakly acid adding sodium sulphoxylate-formaldehyde Develop bichromate WOOL: Dye weakly acid Develop bichromate FASTNESS WOOL (ISO): Light 4–5, 5, — Washing 4	SILK: Dye weakly acid adding sodium sulphoxylate-formaldehyde Develop bichromate WOOL: Dye weakly acid adding ammonium sulphate. Develop bichromate FASTNESS WOOL (ISO): Light 5–6 Washing 5	**TEXTILE APPLICATION OTHER THAN COTTON**
				NON-TEXTILE USAGE

C.I. Vat Yellow	Solubilised 8	9	10	11
C.I. Constitution Number or Chemical Class	60605	66510	65430	70405
Hue Artificial Light	Bright Yellow Redder	Reddish Yellow→Yellowish Orange Redder	Bright Reddish Yellow Redder	Bright Greenish Yellow Redder
Reaction with conc. sulphuric acid (on cellulose)		Yellow		
DYEING				
Method		1+	1, 2	1 (2)
Vatting Temp. °C		50–60	50 (Short liquor)	50–60
Dyeing Temp. °C		60	45–55	50–60
Leuco Alkaline		Olive	Bordeaux	Violet
Acid		Yellowish Brown	Yellowish Brown	Reddish Brown
Substantivity		High	Moderate	High
Levelling		Good	Good	Good
Remarks		Dead cotton covered very well	Dead cotton covered moderately well For maximum yield, reduce NaOH and increase NaCl	Dead cotton covered moderately well
PRINTING				
Direct	✓	×	×	✓
Coloured Resist	✓	—	—	✓
White Resist	✓	—	—	—
Coloured Discharge	×	—	—	—
White Discharge	✓	—	—	×
Flash Ageing	×	—	—	—
Remarks	Develop with chlorate, nitrite or bichromate			
FASTNESS				
Testing Method	ISO	AATCC / ISO	AATCC / ISO	ISO
Cross Dyeing	—	4–5 / —	— / —	—
Hot Pressing	—	3–4 / 3–4	5 / 5	5
Hypochlorite	5	4–5 / 5	5 / 5	4–5
Light	5, 6, 6–7	5, 5–6, 5–6 / 5, 5–6, 6	7 / 6–7, 7, 7	4, 4, 5
Mercerising	—	4 / 5	4–5 / 5	4–5
Peroxide Bleach	—	4 / 4–5	5 / 5	4–5
Soda Boil	3–4	4 / 4	— / 4–5	4
Soda Boil (Hypochlorite)	—	— / Suitable	4–5 / Suitable	Suitable
Washing Alteration	4–5	— / —	— / 5	—
Staining	—	— / —	— / 5	—
Remarks		Accelerates tendering on exposure to light		Accelerates tendering on exposure to light
TEXTILE APPLICATION OTHER THAN COTTON		SILK: Substantivity, high Levelling, good	SILK: Substantivity, poor Levelling, good	SILK: Substantivity moderate FASTNESS SILK (ISO): Light 4, 4–5, 5 Peroxide 4–5 Washing (Alt) 5
NON-TEXTILE USAGE				

12	13	14	15	C.I. Vat Yellow
65405	65425	—	Anthraquinone	C.I. Constitution Number or Chemical Class
Yellow Redder, brighter	Yellow Redder	Reddish Yellow Redder	Yellow	Hue Artificial Light
Olive			Brown	Reaction with conc. sulphuric acid (on cellulose)
2 (1)* 50 45–50 Dull Green Dull Yellowish Brown — Good *Method 1 requires addition of NaCl Dead cotton covered moderately well	2 (3)* 50 50 Dull Green Yellowish Orange High Good *Method 3 suitable for shading only Dead cotton covered moderately well	2 (1, 3) 40–50 50 Bordeaux Dark Red — —	2 50 50 Red Dull Yellow High Good For maximum colour yield reduce NaOH and increase NaCl	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
√ √ √ √ — —	× — — √ — —	√* √ √ × × — *Requires addition of urea	√* — — — — — *Pale and medium dyeings only	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
ISO — 5 5 5, 5, 6 2 5 4–5 — 5 5	ISO 5 4 5 4, 5, 5 3 4 5 4–5 4–5 5	ISO 5 3–4 4–5 6–7, 6–7, 7 3 4–5 4–5 4–5 5 5 Accelerates tendering on exposure to light	AATCC — — 4–5 6, 6, 7 4 4–5 — — — —	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
SILK: Suitable FASTNESS SILK (ISO): Light 5, 5–6, 6 Peroxide 5 Washing 5	VISCOSE: Low substantivity at low temperatures SILK: Suitable FASTNESS SILK (ISO): Light 3–4, 4, 4 Peroxide 4–5 Washing Alt. 5 St. 5			**TEXTILE APPLICATION OTHER THAN COTTON**
PAPER: Stock colouration				**NON-TEXTILE USAGE**

C.I. Vat Yellow	16	17	18	19	20
C.I. Constitution Number or Chemical Class	Anthraquinone		66500	Anthraquinone	68420
Hue Artificial Light	Yellow Redder		Bright Reddish Yellow Redder	Yellow Little change	Yellow Slightly redder
Reaction with conc. sulphuric acid (on cellulose)	Dull Yellowish Brown		Yellow	Orange	
DYEING					
Method	2		1 (2, 3)	2	2 (1, 3)
Vatting Temp. °C	50		60	50	50
Dyeing Temp. °C	50		60	50	45–50
Leuco Alkaline	Reddish Black		Brownish Olive	Black	Reddish Brown
Acid	Brown		Reddish Brown	Yellowish Brown	Reddish Orange
Substantivity	High		Moderate	Very high	—
Levelling	Good		Very good	Good	Very good
Remarks			Dead cotton covered well		Thorough soaping necessary to develop the true hue. When dyeing by method 1, add NaCl
PRINTING		This C.I. Generic Name is discontinued			
Direct	×		×	✓	✓
Coloured Resist	—		—	—	—
White Resist	—		—	—	—
Coloured Discharge	—		—	—	—
White Discharge	—		—	—	—
Flash Ageing	—		—	—	—
Remarks					
FASTNESS					
Testing Method	AATCC		ISO	AATCC	ISO
Cross Dyeing	—		—	—	—
Hot Pressing	3		5	—	4–5
Hypochlorite	5		4–5	4–5	4
Light	4		4–5, 5–6, 6	4	6–7, 7, 7–8
Mercerising	3–4		4–5	—	4
Peroxide Bleach	4		4	4–5	5
Soda Boil	—		3–4	—	4
Soda Boil (Hypochlorite)	—		Suitable	—	Suitable
Washing Alteration	—		—	—	5
Staining	—		—	—	5
Remarks			Accelerates tendering on exposure to light		
TEXTILE APPLICATION OTHER THAN COTTON	SILK: Suitable FASTNESS SILK (AATCC): Light 2–3 Peroxide 5 WOOL: Suitable				
NON-TEXTILE USAGE					See C.I. Pigment Yellow 108

21	22	22:1	23	24	25	C.I. Vat Yellow
69705 Yellow Redder	Anthraquinone Bright Yellow Redder		65420 Bright Yellow→Reddish Yellow Slightly redder	Anthraquinone Yellow Unchanged		C.I. Constitution Number or Chemical Class Hue Artificial Light
	Scarlet			Yellow		Reaction with conc. sulphuric acid (on cellulose)
2 (3) 50–60 50 Brown Bright Yellow High Moderate	2 50 50 Reddish Brown Greenish Yellow Very high Good		2, 3, (1) 50 2, (40–50); 3, (25–30) Bordeaux Reddish Brown — — Method 1 for shading only	2, (3) 40–50 40–50 Dull Orange Red — — Method 3 for shading only		**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
× — — ✓ — —	× — — — — ✓	Usage/properties: Similar to C.I. Vat Yellow 22 Slightly different chemically	✓ ✓ — ✓ — —	✓ — — ✓ — —	This C.I. Generic Name is discontinued	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
AATCC ISO — — 5 5 5 5 3, 4, 5 4, 5, 5–6 — 4–5 4 5 — 4 — — — — — — Accelerates tendering on exposure to light	AATCC — 5 4–5 6 2 4–5 — — — —		ISO 5 3–4 5 4–5, 5, 5–6 2 4–5 4–5 4–5 5 5	AATCC ISO — 4–5 5 3 4–5 4–5 4–5 4–5, 5, 5–6 5 5 4–5 4–5 — 3–4 — 3–4 — 4 — 5		**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
	WOOL: Suitable FASTNESS WOOL (AATCC): Light 7 Washing 3–4		SILK: Suitable	SILK: Suitable		**TEXTILE APPLICATION OTHER THAN COTTON**
						NON-TEXTILE USAGE

C.I. Vat Yellow	26	26:1	27	28
C.I. Constitution Number or Chemical Class	65410		56080	69000
Hue Artificial Light	Greenish Yellow Slightly redder		Bright Greenish Yellow Redder	Reddish Yellow Redder
Reaction with conc. sulphuric acid (on cellulose)	Yellow		Yellowish Red	Dull Bluish Red
DYEING				
Method	3 (2)		3, (2)	3
Vatting Temp. °C	50 (Short liquor)		45–50	40
Dyeing Temp. °C	25		25–35	20–25
Leuco Alkaline	Bordeaux		Dull Brown	Reddish Brown
Acid	Yellowish Brown		Dull Brown	Yellowish Brown (green fluorescence)
Substantivity	Moderate		Low	Moderate
Levelling	Very good		Very good	Good
Remarks	Dead cotton covered well For method 3, reduce NaOH by 20% Oxidise without rinsing		Dead cotton covered well	Keep alkalinity of dyebath low Additional salt may be necessary Soap thoroughly to develop true hue Dead cotton covered moderately well
PRINTING				
Direct	✓		✓*	✓
Coloured Resist	✓		✓	✓
White Resist	—		—	—
Coloured Discharge	✓		✓	✓
White Discharge	—		—	—
Flash Ageing	✓		✓	—
Remarks	Good steaming conditions necessary Oxidise with peroxide as bichromate causes dulling		To avoid excessive greenness increase alkali and reduce sulphoxylate Oxidise with peroxide and ammonia	
FASTNESS				
Testing Method	AATCC ISO		ISO	AATCC ISO
Cross Dyeing	4–5 5		5	5 —
Hot Pressing	5 5		5	4 4–5
Hypochlorite	— 5		5	5 5
Light	4–5 5, 5–6, 6		5, 6, 6–7	5, 6–7, 7 5–6, 6, 6–7
Mercerising	3 3		5	4 4–5
Peroxide Bleach	4–5 5		5	4–5 4–5
Soda Boil	— 4		4–5	4–5 4–5
Soda Boil (Hypochlorite)	— 3–4		Suitable	— Suitable
Washing Alteration	— 4–5		5	— 5
Staining	— 5		5	— 5
Remarks	Accelerates tendering on exposure to light			Accelerates tendering on exposure to light
TEXTILE APPLICATION OTHER THAN COTTON	VISCOSE: Use method 2. Substantivity lower at lower temperatures. Dyes slightly duller at high temperatures. For data on strike, see *JSDC*, **55** (1939) 496 SILK: Substantivity and levelling good FASTNESS SILK (ISO): Light 5, 5, 5 Peroxide 5 Washing 5			VISCOSE: For data on strike, rate of diffusion and time of half-dyeing see *JSDC*, **55** (1939) 481 SILK: Suitable FASTNESS SILK (ISO): Light 7, 7–8, 8 Peroxide 5 Washing 5
NON-TEXTILE USAGE				

USAGE/PROPERTIES: Similar to C.I. Vat Yellow 26 Slightly different chemically

29	30	31	32	33	C.I. Vat Yellow
68400 Bright Greenish Yellow Redder	Anthraquinone Yellow Slightly redder	68405 Yellow Unchanged		Anthraquinone Bright Yellow Redder	C.I. Constitution Number or Chemical Class Hue Artificial Light
Yellowish Red		Yellow			Reaction with conc. sulphuric acid (on cellulose)
3, (2) 50 (Short liquor) 20–25 Reddish Brown Brown Moderate Very good When dyeing by method 3, reduce NaOH by 20% Thoroughly oxidise before rinsing	3, (2) 40–50 25–30 Bordeaux Bordeaux — —	3, (2) 50 (Short liquor) 20–25 Reddish Brown Brown Moderately good — When dyeing by method 3, reduce NaOH by 20%. Protect unoxidised dyeings from direct sunlight Oxidise without rinsing		2, (1) 50 50 Dull Reddish Violet Yellow High Very good Not recommended for high temperature dyeing Dead cotton covered moderately well	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
✓ ✓ — ✓ — —	✓ ✓ — ✓ — —	× — — ✓ — —	This C.I. Generic Name is discontinued	× — — — — ✓	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
ISO — 5 5 5, 5–6, 5–6 5 4 4–5 Suitable 5 4–5	ISO 5 5 5 5–6, 6, 6 5 4–5 5 Suitable 4–5 5	ISO — 4–5 5 6–7, 7, 7 4 4–5 4 Suitable — —		ISO 5 3–4 5 6, 6–7, 7 5 5 5 5 5 5	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
VISCOSE: For data on strike see *JSDC*, **55** (1939), 496 SILK: Only of moderate interest on account of poor fastness to degumming	SILK: Suitable	VISCOSE: For data on strike see *JSDC*, **55** (1939), 496 SILK: Only of moderate interest on account of poor fastness to degumming			**TEXTILE APPLICATION OTHER THAN COTTON**
					NON-TEXTILE USAGE

C.I. Vat Yellow	34	35	36	37	38—40	41
C.I. Constitution Number or Chemical Class	Anthraquinone	Sulphur		Acylamino-Anthraquinone		Anthraquinone
Hue Artificial Light	Bright Greenish Yellow Redder	Yellow Slightly duller		Bright Reddish Yellow Redder		Greenish Yellow Redder
Reaction with conc. sulphuric acid (on cellulose)	Scarlet	Yellowish Brown		Red		Orange
DYEING						
Method	2	1 (Special)		2, (1)		2
Vatting Temp. °C	50	60–70		50		50
Dyeing Temp. °C	50	60–70		50–60		50
Leuco Alkaline	Brownish Yellow	Orange		Bordeaux		Claret
Acid	Greenish Yellow	Brownish Yellow		Yellowish Brown		Yellowish Brown
Substantivity	High	Moderate		High		Moderate
Levelling	—	Very good		Very good		Very good
Remarks		Also applicable by special method using NaOH, Na_2S_n and $Na_2S_2O_4$ (vatting Temp. 70–80) and as sulphur dye Rinse immediately and then in an acid bath		Dead cotton covered moderately well		Leuco compound not stable above 60°C Low alkalinity, high salt concentration, and moderate dyeing temperature are required
PRINTING			This C.I. Generic Name is discontinued		These C.I. Generic Names are discontinued	
Direct	✓	×		×		×
Coloured Resist	—	×		—		—
White Resist	—	—		✓		—
Coloured Discharge	—	×		×		—
White Discharge	—	—		—		—
Flash Ageing	—	—		✓		—
Remarks						
FASTNESS						
Testing Method	AATCC	ISO		ISO		AATCC
Cross Dyeing	—	—		5		4–5
Hot Pressing	4–5	5		4–5		5
Hypochlorite	4	3		5		4
Light	—, 6, —	3–4		5–6, 6, 6–7		6, 6, 6–7
Mercerising	—	4–5		4		4
Peroxide Bleach	3–4	—		4–5		4
Soda Boil	—	Unsuitable		4–5		5
Soda Boil (Hypochlorite)	—	Unsuitable		Suitable		—
Washing Alteration	4 (III)	—		5		—
Staining	—	—		5		—
Remarks						
TEXTILE APPLICATION OTHER THAN COTTON				SILK: Suitable		
NON-TEXTILE USAGE						

42	43	44	Solubilised 45	46	C.I. Vat Yellow
Anthraquinone Bright Greenish Yellow Redder		59110 Reddish Yellow Redder	Anthraquinone Greenish Yellow	Anthraquinone Yellow No change	C.I. Constitution Number or Chemical Class Hue Artificial Light
Orange				Greenish Yellow	Reaction with conc. sulphuric acid (on cellulose)
2 50 50 Reddish Brown Yellowish Brown Moderate Very good Leuco compound not stable above 60°C Requires low alkalinity, high salt concentration and moderate dyeing temperature		3 — — Bordeaux Yellow — —	Develop by the nitrite process Dead cotton covered well	1, 2, (1+, 3) 55 60 Violet Red Brown — Very good Dyes level over a wide range of conditions and can be used for shading other dyes by all methods	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
✓ ✓ ✓ ✓ × —	This C.I. Generic Name is discontinued	✓ — — — — —	✓ — — — — × Develop by the nitrite process	✓ ✓ — × × ✓	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
AATCC 5 5 5 6, 6, 6–7 4 4–5 5 — 4–5 5		ISO — — 4–5 6, 6–7, 7 — 4–5 2–3 — 4–5 4–5 Accelerates tendering on exposure to light	ISO 5 5 — 6 4–5 — 4 — 5 5	ISO 5 5 5 5–6, 6, 6–7 2 4 4 — 4–5 5	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
					TEXTILE APPLICATION OTHER THAN COTTON
					NON-TEXTILE USAGE

C.I. Vat Yellow	Solubilised 47	48		
C.I. Constitution Number or Chemical Class	Anthraquinone	Anthraquinone		
Hue Artificial Light	Greenish Yellow	Bright Yellow		
Reaction with conc. sulphuric acid (on cellulose)				
DYEING				
Method		2, (1)		
Vatting Temp. °C		50		
Dyeing Temp. °C		50		
Leuco Alkaline		Dull Red		
Acid		—		
Substantivity		—		
Levelling		Good		
Remarks				
PRINTING				
Direct	✓	✓		
Coloured Resist	✓	—		
White Resist	—	—		
Coloured Discharge	—	✓		
White Discharge	—	✓		
Flash Ageing	×	—		
Remarks	Develop by nitrite or chlorate			
FASTNESS				
Testing Method	ISO	JIS		
Cross Dyeing	—	—		
Hot Pressing	—	5		
Hypochlorite	—	—		
Light	5–6	6, 6–7, 6–7		
Mercerising	—	4–5		
Peroxide Bleach	—	5		
Soda Boil	—	5		
Soda Boil (Hypochlorite)	—	—		
Washing Alteration	4–5	5		
Staining	—	5		
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON				
NON-TEXTILE USAGE				

C.I. Vat Orange	1	Solubilised 1	2	Solubilised 2
C.I. Constitution Number or Chemical Class	59105	59106	59705	59706
Hue Artificial Light	Bright Yellowish Orange Slightly redder		Bright Reddish Orange Yellower	
Reaction with conc. sulphuric acid (on cellulose)			Blue	
DYEING				
Method	3, (2)		1, (2)	
Vatting Temp. °C	50 (Short liquor)		50–60	
Dyeing Temp. °C	25		50–60	
Leuco Alkaline	Bordeaux		Reddish Violet	
Acid	Orange		Orange	
Substantivity	High	High	High	Poor
Levelling	Good		Good	
Remarks	For method 3, the usual quantities of salt may not be required Dead cotton covered moderately well	Dye neutral or weakly alkaline at 20–30°C, adding NaCl Develop nitrite (hot or cold) Applicable by the one-bath method (develop at 30°C)	Protect unoxidised dyeings from direct sunlight Soap thoroughly to develop the true hue When dyeing by method 2, increase the NaOH by 15%	Dye neutral or weakly alkaline Develop with nitrite
PRINTING				
Direct	✓	✓*	✓	✓
Coloured Resist	✓	✓	✓	✓
White Resist	—	✓	—	✓
Coloured Discharge	✓	—	✓	✓
White Discharge	✓	✓	×	×
Flash Ageing	✓	×	✓	×
Remarks	Applicable in strongly alkaline print pastes	*Develop with chlorate, nitrite or bichromate	Avoid strongly alkaline pastes and use of anthraquinone. Oxidise with peroxide as bichromate causes dulling	Develop with chlorate or nitrite
FASTNESS	AATCC / ISO		AATCC / ISO	
Testing Method	5 / 5		4 / 5	
Cross Dyeing	5 / 4		4 / 4	
Hot Pressing	5 / 5		4 / 5	
Hypochlorite	5–6, 6–7, 7 / 6, 6–7, 7		5, 6, 7 / 5, 6, 6–7	
Light	5 / 5		4–5 / 4	
Mercerising	4 / 4		5 / 4–5	
Peroxide Bleach	3–4 / 3–4		5 / 4	
Soda Boil	3–4 / 3–4		— / 4	
Soda Boil (Hypochlorite)	— / 5		— / 4–5	
Washing Alteration	— / 5		— / 5	
Staining				
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON	SILK: Suitable FASTNESS SILK (ISO): Light 6–7, 7–8, 7–8 Peroxide 5 Washing 5 Degumming 3–4	SILK: Dye weakly acid adding sodium sulphoxylate-formaldehyde Develop with bichromate WOOL: Dye weakly acid adding Na_2SO_4 Develop with bichromate	VISCOSE: For data on strike, rate of diffusion and time of half-dyeing see *JSDC*, 55 (1939), 481 SILK: Substantivity, high; levelling, good FASTNESS SILK (ISO): Light 6, 6–7, 7 Peroxide 5 Washing 5 WOOL: Suitable	SILK: Dye weakly acid adding sodium sulphoxylate-formaldehyde Develop with bichromate WOOL: Dye weakly acid adding sodium sulphoxylate-formaldehyde Develop with bichromate
NON-TEXTILE USAGE	PAPER: Stock colouration			

C.I. Vat Orange	3	Solubilised 3	4	Solubilised 4
C.I. Constitution Number or Chemical Class	59300	59301	59710	59711
Hue Artificial Light	Bright Reddish Orange Slightly yellower		Reddish Orange Yellower	
Reaction with conc. sulphuric acid (on cellulose)	Yellowish Green		Blue	
DYEING				
Method	3, (2)		1	
Vatting Temp. °C	40–50		45–55	
Dyeing Temp. °C	25–30		45–55	
Leuco Alkaline	Reddish Violet		Violet	
Acid	Orange		Orange	
Substantivity	Moderate	Low	Moderate	Good
Levelling	Very good		Good	
Remarks	Protect unoxidised dyeings from direct sunlight Soap thoroughly to develop the true hue	Dye neutral or weakly alkaline at 20–30°C Develop with nitrite (hot or cold). Substantivity improved by adding salt but avoid excess or precipitation results	Avoid the use of hard water, excess hydrosulphite and high temperatures Protect unoxidised dyeings from direct sunlight	Dye neutral at 60°C Substantivity good and improved by adding NaCl but avoid excess or precipitation results Develop with nitrite
PRINTING				
Direct	✓	✓	✓	✓
Coloured Resist	✓	✓	✓	✓
White Resist	—	✓	—	✓
Coloured Discharge	✓	✓	✓	—
White Discharge	✓	✓	×	×
Flash Ageing	✓	×	✓	×
Remarks	Oxidation by peroxide preferable as bichromate causes dulling	Develop with chlorate, nitrite or bichromate	Avoid strongly alkaline print pastes Oxidation with bichromate does not alter the hue	Develop with chlorate, nitrite or bichromate
FASTNESS	AATCC / ISO		AATCC / ISO	
Testing Method	AATCC	ISO	AATCC	ISO
Cross Dyeing	5	5	5	5
Hot Pressing	5	4	4–5	4–5
Hypochlorite	5	5	5	5
Light	6, 6–7, 7	7, 7, 7–8	5, 5–6, 6–7	5–6, 6–7, 7
Mercerising	4–5	4–5	4	4
Peroxide Bleach	4	4	4–5	4–5
Soda Boil	3–4	3–4	4–5	4–5
Soda Boil (Hypochlorite)	3–4	4	4	4–5
Washing Alteration	—	4–5	—	5
Staining	—	5	—	5
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON	VISCOSE: Moderate substantivity cold. Weaker dyeings at higher temperatures For data on strike, see *JSDC*, **55** (1939), 481 SILK: Substantivity, moderate; levelling, very good FASTNESS SILK (ISO): Light 7, 7–8, 8 Peroxide 5 Washing 5	SILK: Dye neutral at 80–90°C. Exhaustion improved by adding ammonium sulphate or acetic acid. Good substantivity, develop with bichromate or ammonium persulphate WOOL: Dye neutral or weakly acid adding ammonium sulphate Develop with bichromate	SILK: Substantivity and levelling, good FASTNESS SILK (ISO): Light 6, 6, 6–7 Peroxide 5 Washing 5 Degumming 4 WOOL: Suitable	SILK: Dye weakly acid adding sodium sulphoxylate-formaldehyde Good substantivity Develop with bichromate WOOL: Dye neutral. Exhaust with acetic acid Substantivity good Develop with bichromate
NON-TEXTILE USAGE	See C.I. Pigment Red 168		See C.I. Pigment Red 197	

5	Solubilised 5	Solubilised 6	7	8	C.I. Vat Orange
73335	73336	Anthraquinone–Azo	Anthraquinone		C.I. Constitution Number or Chemical Class
Bright Reddish Orange Slightly yellower		Yellowish Orange Yellower	Yellowish Orange Yellower		Hue Artificial Light
Violet					Reaction with conc. sulphuric acid (on cellulose)
4 70–80 45–55 Yellow Yellow Moderately high Very good The alkalinity of the bath must be maintained by the addition of NaOH or Na_2CO_3	Poor Substantivity increased by adding NaCl Develop with nitrite (hot or cold) Applicable by the one-bath process	Moderate Dye neutral. Substantivity improved by adding Na_2SO_4 Develop with nitrite Applicable by the one-bath method	1+ 60–75 60–70 Olive (red fluorescence) Reddish Brown High Good High caustic soda concentration essential for maximum yield		**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
✓ ✓ ✓ ✓ ✓ ×	✓ ✓ ✓ — ✓ × Develop with chlorate, nitrite, bichromate or copper sulphate	× — — ✓ — × Develop with nitrite	✓ ✓ — ✓ — —	This C.I. Generic Name is discontinued	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
AATCC / ISO 4 / 3–4 5 / 4 4–5 / 4 3, 4, 5 / 4, 4–5, 5 4 / 4 3 / 4 4 / 3–4 — / 3–4 — / 4 — / 4–5 Accelerates tendering on exposure to light		ISO — 4–5 5 5–6, 6, — 4–5 5 3–4 — — —	ISO — 4 5 6, 6, 6–7 5 4–5 3–4 Suitable 5 5		**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
SILK: Substantivity, moderate; levelling, very good FASTNESS SILK (ISO): Light 4, 4–5, 5 Peroxide 4–5 Washing 5 Degumming 3 VISCOSE: For data on strike, rate of diffusion and time of half-dyeing, see *JSDC*, **55** (1939), 481	SILK: Dye weakly acid at 80–90°C adding sodium sulphoxylate-formaldehyde. Exhaust with formic acid Develop with bichromate WOOL: Dye weakly acid Develop with nitrite or bichromate	SILK: Dye weakly acid adding sodium sulphoxylate-formaldehyde Develop with bichromate WOOL: Dye neutral. Exhaust with acetic acid Develop with bichromate FASTNESS WOOL (ISO): Light ($\frac{1}{10}$N) 6, ($\frac{1}{3}$N) 6–7, (N) 7 Milling 4–5 Washing 5			**TEXTILE APPLICATION OTHER THAN COTTON**
			See C.I. Pigment Orange 43		**NON-TEXTILE USAGE**

C.I. Vat Orange	9	Solubilised 9	10
C.I. Constitution Number or Chemical Class	59700	59701	Anthraquinone
Hue Artificial Light	Yellowish Orange Slightly redder		Yellowish Orange Slightly redder
Reaction with conc. sulphuric acid (on cellulose)	Blue		
DYEING			
Method	1, (2)		2, (3)
Vatting Temp. °C	50–60		40–50
Dyeing Temp. °C	50–60		40–50
Leuco Alkaline	Bluish Red		Deep Red
Acid	Orange		Orange
Substantivity	High		
Levelling	Good		
Remarks	For method 2 increase NaOH by 15% Stock vats tend to crystallise on standing. Protect unoxidised dyeings from direct sunlight Soap thoroughly		Method 3 suitable for shading only
PRINTING			
Direct	✓		×
Coloured Resist	✓		×
White Resist	—		—
Coloured Discharge	✓		×
White Discharge	×		—
Flash Ageing	✓		—
Remarks	Oxidation with bichromate does not alter the hue Avoid addition of anthraquinone		

FASTNESS				
Testing Method	AATCC	ISO	AATCC	ISO
Cross Dyeing	4	5	—	5
Hot Pressing	4	4	5	4
Hypochlorite	5	5	4	5
Light	5, 5–6, 6	5, 5–6, 6	—, 4–5, —	4–5, 5, 5–6
Mercerising	4–5	4–5	4	5
Peroxide Bleach	5	4–5	3	3–4
Soda Boil	4	4–5	—	4–5
Soda Boil (Hypochlorite)	—	4–5	—	4–5
Washing Alteration	—	4–5	—	3–4
Staining	—	5	—	5
Remarks				

TEXTILE APPLICATION OTHER THAN COTTON	VISCOSE: Substantivity, high; levelling, good. For data on strike, rate of diffusion and time of half-dyeing, see *JSDC*, **55** (1939), 481 SILK: Substantivity, high; levelling, good COIR: Suitable		SILK: Suitable
NON-TEXTILE USAGE	See C.I. Pigment Orange 40		

11	11:1	Solubilised 11	12	13	C.I. Vat Orange
70805		70806	Anthraquinone	67820	C.I. Constitution Number or Chemical Class
Yellowish Orange Slightly redder			Yellowish Orange Slightly redder	Orange→Reddish Orange Brighter and yellower	Hue Artificial Light
			Reddish Brown	Yellow	Reaction with conc. sulphuric acid (on cellulose)
2, (1, 3) 50 50 Dull Reddish Brown Dull Yellow High Good A longer vatting period than usual is advisable For method 1, add NaCl	Purified form of C.I. Vat Orange 11	Moderate Develop with nitrite	2 50 50 (or 25 for shading) Dull Orange Yellow Low Good Dead cotton covered moderately well	2, (1, 3) 45–50 45–50 Bluish Bordeaux Orange Brown High Very good When dyeing by method 1, addition of salt is necessary Method 3, suitable for shading only	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
✓ — — — — ✓ Duller and browner shades obtained by printing		✓ ✓ ✓ × — × Develop with nitrite, chlorate or sulphocyanide	× × — × — —	✓ ✓ — ✓ — —	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
AATCC / ISO 5 / 5 3–4 / 3 5 / 5 6, 7, 7–8 / 6–7, 7, 7–8 5 / 4–5 5 / 5 5 / 4–5 — / 5 — / 5 — / 5			ISO 4–5 3 4–5 5–6, 6, 6–7 5 4–5 3–4 4 4 5	ISO — 5 5 7, 7–8, 7–8 4 4–5 4 Suitable 4–5 5	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
VISCOSE: For data on strike, see *JSDC*, **55**, (1939), 496 SILK: Substantivity, high FASTNESS SILK (ISO): Light 6–7, 7, 7–8 Peroxide 5 Washing 5 Degumming 4 WOOL: Suitable		SILK: Suitable WOOL: Suitable	VISCOSE: Low substantivity at low temperatures Dyes redder and duller at high temperatures UNIONS: Good solidity on cotton/viscose dyed cold Viscose dyed heavier than cotton at 50°C	VISCOSE: For data on strike, rate of diffusion and time of half-dyeing, see *JSDC*, **55** (1939), 481 SILK: Substantivity, high; levelling, good FASTNESS SILK (ISO): Degumming 4 Light 6, 7, 7 Peroxide 5 Washing 5	**TEXTILE APPLICATION OTHER THAN COTTON**
PAPER: Stock colouration					**NON-TEXTILE USAGE**

C.I. Vat Orange	14	15	16	17
C.I. Constitution Number or Chemical Class	Anthraquinone	69025	69540	65415
Hue Artificial Light	Yellowish Orange Redder	Yellowish Orange Redder	Reddish Orange Yellower	Orange Yellower
Reaction with conc. sulphuric acid (on cellulose)	Blue	Greenish Blue	Reddish Yellow	Brown
DYEING				
Method	2, (1, 3)	2, (3)	2, (3)	2, (1, 3)
Vatting Temp. °C	50	50 (Short liquor)	45–50	45–50
Dyeing Temp. °C	50	50	45–50	45–50
Leuco	Reddish Brown	Brown	Dull Violet	Bordeaux
Alkaline	Yellow	Dull Yellow	Reddish Brown	Dull Orange
Acid	Low	High	High	—
Substantivity	Very good	Good	Very good	Very good
Levelling	When dyeing by method 1, the temperature should not exceed 50	For data on strike, levelling and migration, see *JSDC*, **66** (1950), 505	Protect unoxidised dyeings from direct sunlight	For method 1, an addition of salt is required
Remarks	Dead cotton covered moderately well	Dead cotton covered moderately well		Methods 1 and 3 are suitable for shading
PRINTING				
Direct	×	✓	✓	✓
Coloured Resist	×	✓	✓	✓
White Resist	—	—	—	—
Coloured Discharge	×	✓	✓	✓
White Discharge	×	✓	×	✓
Flash Ageing	—	✓	—	—
Remarks		Additional steaming needed to obtain maximum yield Bichromate causes dulling		
FASTNESS				
Testing Method	ISO	AATCC ISO	AATCC ISO	ISO
Cross Dyeing	5	4–5 5	4 —	—
Hot Pressing	Yellower	5 4	5 5	5
Hypochlorite	4–5	5 5	5 5	5
Light	6–7, 7, 7	5–6, 6, 6–7 6, 6, 6–7	5–6, 6, 6–7 7, 7, 7–8	—, 7–8, —
Mercerising	4–5	5 5	5 4	3
Peroxide Bleach	4–5	5 4–5	4 4–5	4–5
Soda Boil	4–5	4–5 4–5	4 3	4–5
Soda Boil (Hypochlorite)	—	4–5 4–5	— Unsuitable	Suitable
Washing Alteration	—	— 5	— 4–5	4–5
Staining	—	— 5	— 5	5
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON	VISCOSE: Low substantivity at low temperatures Dyes slightly yellower at higher temperatures SILK: Suitable	VISCOSE: Good substantivity at low temperatures Redder and duller hue at high temperature COTTON/VISCOSE: Good solidity dyed cold SILK: Suitable FASTNESS SILK (ISO): Degumming 4–5 Light 7, 7, 7 Peroxide 5 Washing 5	VISCOSE: For data on strike, rate of diffusion and time of half-dyeing, see *JSDC*, **55** (1939), 481	SILK: Suitable, method 2 FASTNESS SILK (ISO): Degumming 4 Light 6, 6–7, 7 Peroxide 4–5 Washing 5 COTTON/VISCOSE: Good solidity
NON-TEXTILE USAGE		PAPER: Stock colouration INKS, PAINT, PLASTICS		

18	19	19:1	20	21	C.I. Vat Orange
65705	59305		65025	69700	C.I. Constitution Number or Chemical Class
Bright Reddish Orange Brighter and redder	Bright Orange Slightly yellower		Yellowish Orange Brighter and Yellower	Yellowish Orange Brighter	Hue Artificial Light
Red	Yellowish Green			Reddish Violet	Reaction with conc. sulphuric acid (on cellulose)
2, (3) 45–50 45–50 Dull Orange Yellow Moderate Good Method 3 suitable for shading only For data on strike, levelling and migration, see *JSDC*, **66** (1950), 505	3, (2) 45–50 25–30 Reddish Violet Orange Poor Very good Dead cotton covered fairly well	USAGE/PROPERTIES: Similar to C.I. Vat Orange 19 Slightly different chemically	2, (3) 50 (Short liquor) 50 Reddish Brown Yellow — —	2, (3) 50 (Short liquor) 50 Brown Orange — —	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
√ √ — √ × √ Avoid strongly alkaline pastes Oxidation with bichromate does not alter the hue	√ √ — √ √ — Increased sodium sulphoxylate-formaldehyde improves colour yield Avoid strongly alkaline pastes		— — — √ — —	— — — — — —	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
AATCC ISO — 4–5 5 3–4 4 5 —, 5–6, — 5–6, 6, 6–7 5 5 3–4 4 — 3–4 — 3–4 — 4 — 4	AATCC ISO 5 Very good 4 5 5 5 6–7, 7, 7 7, 7, 7–8 5 4–5 5 4 4 3 4 Unsuitable — 4–5 — 5		ISO — 5 4–5 6, 6–7, 7 4 5 4 — — —	ISO — 5 5 6, 6, 6–7 5 5 4 — — —	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
VISCOSE: Suitable SILK: Suitable	SILK: Moderately suitable but of little interest		SILK: Suitable		**TEXTILE APPLICATION OTHER THAN COTTON**
					NON-TEXTILE USAGE

C.I. Vat Orange	22	23	24	25
C.I. Constitution Number or Chemical Class	Anthraquinone	Anthraquinone	Anthraquinone	
Hue Artificial Light	Yellowish Orange	Bright Yellowish Orange Redder	Bright Yellowish Orange Redder	
Reaction with conc. sulphuric acid (on cellulose)		Reddish Blue	Violet	
DYEING				
Method		1, 2	2	This C.I. Generic Name is discontinued
Vatting Temp. °C		50–60	50	
Dyeing Temp. °C		50–60	50	
Leuco Alkaline		Red	Red	
Acid		Reddish Yellow	Yellow	
Substantivity		High	High	
Levelling		—	Good	
Remarks				
PRINTING				
Direct	✓	✓	✓	
Coloured Resist	✓	✓	✓	
White Resist	—	—	—	
Coloured Discharge	✓	✓	✓	
White Discharge	—	—	—	
Flash Ageing	✓	—	—	
Remarks				
FASTNESS				
Testing Method	ISO	AATCC	AATCC	
Cross Dyeing	—	—	—	
Hot Pressing	—	4–5	4–5	
Hypochlorite	5	4	4–5	
Light	5, 5–6, 6	—, 5–6, —	—, 5, —	
Mercerising	—	—	—	
Peroxide Bleach	4–5	4–5	4–5	
Soda Boil	—	—	—	
Soda Boil (Hypochlorite)	—	—	—	
Washing Alteration	4–5	4–5	4–5	
Staining	4–5	—	—	
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON				
NON-TEXTILE USAGE				

26	27	28	C.I. Vat Orange
Anthraquinone Orange Redder	Anthraquinone Reddish Orange Redder	Anthraquinone Reddish Orange Yellower	C.I. Constitution Number or Chemical Class Hue Artificial Light
Yellow	Red		Reaction with conc. sulphuric acid (on cellulose)
1 50–60 10–90 (115 with formaldehyde) Red Brown Yellowish Orange High Good Dead cotton covered well	2, (1) 50 50 Brown, turbid Reddish Brown High Moderate Dead cotton covered well	2, (1+, 3) 60 45–115 Reddish Violet Yellowish Brown High Good Dead cotton covered moderately well	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
× × — × × ✓	✓ × × ✓ ✓ —	✓ ✓ — ✓ ✓ —	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
ISO 4–5 5 4–5 6, 6–7, 6–7 4–5 4–5 4–5 — 4–5 5	ISO — 4 5 5–6, 6–7, 7 3–4 5 4 — 4 4–5	ISO 4–5 5 4–5 6–7, 7, 7 4–5 4–5 4–5 Suitable 4–5 5	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
SILK: Suitable UNIONS: Solid dyeings on cotton/viscose		SILK: Suitable	**TEXTILE APPLICATION OTHER THAN COTTON**
			NON-TEXTILE USAGE

C.I. Vat Red	1	Solubilised 1	2	Solubilised 2
C.I. Constitution Number or Chemical Class	73360	73361	73365	73366
Hue Artificial Light	Bright Bluish Pink→Bright Bluish Red Yellower		Bright Bluish Pink→Bright Bluish Red Yellower and brighter	
Reaction with conc. sulphuric acid (on cellulose)	Red			
DYEING				
Method	4, (2)		4	
Vatting Temp. °C	70–75		70–75	
Dyeing Temp. °C	50		50	
Leuco Alkaline	Yellow		Yellow	
Acid	Light Pink		Colourless	
Substantivity	Moderate	Poor	High	Poor
Levelling	Good		Very good	
Remarks	Protect unoxidised dyeings from direct sunlight Extend time of air oxidation as dye oxidises slowly For strike, levelling and migration, see *JSDC*, **66** (1950), 505	Dye neutral or weakly alkaline at 20–30°C Substantivity improved by adding a little NaCl Development (nitrite) is difficult		Dye neutral or weakly alkaline at 20–30°C Substantivity improved by adding NaCl Development (nitrite) is difficult
PRINTING				
Direct	✓	✓	✓	✓
Coloured Resist	✓	✓	✓	✓
White Resist	✓	✓	—	✓
Coloured Discharge	✓	✓	✓	✓
White Discharge	✓	✓	✓	✓
Flash Ageing	✓	×	✓	×
Remarks	Colour yield improved by increased sulphoxylate-formaldehyde Applicable in strongly alk. pastes. Oxidation by peroxide preferable	Develop by chlorate, nitrite or bichromate		Direct prints developed with nitrite, bichromate or chlorate
FASTNESS	AATCC / ISO		ISO	
Testing Method	AATCC	ISO	Very good	
Cross Dyeing	4	4–5	4	
Hot Pressing	5	5	5	
Hypochlorite	5	4–5	5	
Light	3–4, 4, 5	4–5, 5, 6	5, 5, 5–6	
Mercerising	4	4	4	
Peroxide Bleach	4	4	4	
Soda Boil	5	4–5	3–4	
Soda Boil (Hypochlorite)	—	4–5	Suitable	
Washing Alteration	—	4–5	4–5	
Staining	—	5	5	
Remarks	Acclerates tendering on exposure to light		Accelerates tendering on exposure to light	
TEXTILE APPLICATION OTHER THAN COTTON	VISCOSE: Strike data, see *JSDC*, 55 (1939), 496 SILK: Substantivity, high; levelling, good FASTNESS SILK (ISO): Degumming 4 Light 5–6, 6–7, 7–8 Peroxide 5 Washing 5 WOOL: Substantivity, high FASTNESS WOOL (ISO): Milling 5 Light 6–7, 6–7, 7–8 Peroxide 5 Washing 5	SILK: Dye weakly acid adding sodium sulphoxylate-formaldehyde Develop with bichromate or persulphate WOOL: Dye weakly acid Develop with bichromate using less than normal	SILK: Substantivity, moderate; levelling, good FASTNESS SILK (ISO): Degumming 4 Light 6–7, 7, 7 Peroxide 5 Washing 5 WOOL: Suitable	SILK: Dye weakly acid adding sodium sulphoxylate-formaldehyde Develop with bichromate WOOL: Dye weakly acid adding ammonium sulphate Develop by bichromate using excess
NON-TEXTILE USAGE	See C.I. Pigment Red 181			

C.I. Vat Red	Solubilised 3	4	Solubilised 4	5
C.I. Constitution Number or Chemical Class	Anthraquinone-Azo	Indigoid	Indigoid	73350
Hue Artificial Light	Bluish Red Redder	Dull Bluish Red Yellower and brighter		Bluish Pink→Bluish Red
Reaction with conc. sulphuric acid (on cellulose)		Bluish Grey		
DYEING				
Method		4, 2, (1, 3)		
Vatting Temp. °C		80 (Stock vat)		
Dyeing Temp. °C		40–50 (Method 2)		
Leuco Alkaline		Reddish Orange		
Acid		Yellow		
Substantivity	Moderate	—	Poor	
Levelling		Very good		
Remarks	Dye neutral or weakly alkaline Substantivity improved by adding Na_2SO_4 Develop by nitrite	For method 1, add NaCl	Dye neutral or weakly alkaline Substantivity improved by adding NaCl Develop by nitrite or chlorate	
PRINTING				
Direct	✓	✓	✓	✓
Coloured Resist	✓	✓	✓	✓
White Resist	✓	—	✓	—
Coloured Discharge	—	✓	—	✓
White Discharge	✓	✓	✓	—
Flash Ageing	×	—	×	—
Remarks	Direct prints developed by chlorate or nitrite	Avoid strongly alkaline pastes Oxidation with peroxide preferable as bichromate causes dulling		
FASTNESS				
Testing Method	ISO	AATCC	ISO	ISO
Cross Dyeing	5	—	5	—
Hot Pressing	5	5	4	—
Hypochlorite	3	5	4–5	5
Light	4, 5–6, 6	—, 6, —	6, 6–7, 7	—, 6, —
Mercerising	5	4	4	—
Peroxide Bleach	5	5	5	4–5
Soda Boil	3	—	4	4
Soda Boil (Hypochlorite)	—	—	4–5	—
Washing Alteration	3	—	4–5	—
Staining	—	—	5	—
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON	SILK: Dye weakly acid adding sodium sulphoxylate-formaldehyde Develop by bichromate WOOL: Dye weakly acid Develop by bichromate FASTNESS WOOL (ISO): Light 6–7, 6–7, — Milling 4–5 Washing 5	SILK: Suitable FASTNESS SILK (ISO): Degumming 4–5 Light 6, 6–7, 7 Peroxide 5 Washing 4–5 WOOL: Suitable FASTNESS WOOL (ISO): Milling 4–5 Light 7, 7–8, 7–8 Washing 5	SILK: Dye weakly acid adding sodium sulphoxylate-formaldehyde Develop by bichromate WOOL: Dye weakly acid Substantivity high Develop by bichromate	
NON-TEXTILE USAGE				

6	Solubilised 6	7	8	Solubilised 8	C.I. Vat Red
73355	73356		Indigoid	Indigoid	C.I. Constitution Number or Chemical Class
Bright Pink→Bright Red Yellower and brighter			Bright Bluish Pink		Hue Artificial Light
Green					Reaction with conc. sulphuric acid (on cellulose)
4 70–75 45–50 Greenish Yellow Colourless Moderate Very good	Poor Dye neutral or weakly alkaline at 20–30°C Substantivity improved by adding NaCl Develop by nitrite (hot or cold)	This C.I. Generic Name is discontinued	4	Fairly high Dye neutral or weakly alkaline at 60°C Develop by nitrite	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
✓ ✓ — ✓ ✓ —	✓ ✓ ✓ — ✓ — Direct prints developed by chlorate, nitrite or bichromate		✓ ✓ — ✓ ✓ — Increased sodium sulphoxylate-formaldehyde improves yield Oxidn. with bichromate does not alter hue	✓ ✓ — × ✓ × Direct prints developed by chlorate or nitrite	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
ISO Slightly yellower 5 5 6, 6–7, 7 4 4 3–4 Suitable 4–5 5 Accelerates tendering on exposure to light			ISO — 4–5 5 5–6, 6–7, 7 5 4–5 3–4 — 4 4–5		**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
SILK: Suitable FASTNESS SILK (ISO): Degumming 2–3 Light 6, 7, 7–8 Peroxide 5 WOOL: Suitable FASTNESS WOOL (ISO): Light 6, 7, 7–8 Milling 5 Washing 5	SILK: Dye weakly acid adding sodium sulphoxylate-formaldehyde Substantivity high Develop by bichromate WOOL: Dye weakly acid Substantivity high Develop by bichromate using less than normal		WOOL: Suitable FASTNESS WOOL (ISO): Light 6–7, 6–7, 7 Milling 4–5 Washing 5	SILK: Dye weakly acid adding sodium sulphoxylate-formaldehyde Substantivity high Develop by bichromate WOOL: Dye weakly acid Substantivity high Develop by bichromate	**TEXTILE APPLICATION OTHER THAN COTTON**
					NON-TEXTILE USAGE

C.I. Vat Red	9	Solubilised 9	10	Solubilised 10
C.I. Constitution Number or Chemical Class	Indigoid	Indigoid	67000	67001
Hue Artificial Light	Bluish Pink Yellower		Bluish Red Yellower	
Reaction with conc. sulphuric acid (on cellulose)			Pale Yellow	
DYEING				
Method	4		2, (1, 3)	
Vatting Temp. °C			50	
Dyeing Temp. °C			50	
Leuco Alkaline			Dull Brown	
Acid			Red Brown	
Substantivity		Poor	Moderate	Poor
Levelling			Excellent	
Remarks		Dye weakly alkaline. Substantivity improved by adding NaCl Develop by nitrite	Sensitive to hard water Protect unoxidised dyeings from direct sunlight	Dye neutral or slightly alkaline at 20–30°C. Substantivity improved by adding NaCl Develop by nitrite (hot or cold) in a separate bath. Do not add nitrite to dyebath
PRINTING				
Direct	✓	✓	✓	✓
Coloured Resist	✓	✓	✓	✓
White Resist	—	✓	—	✓
Coloured Discharge	✓	—	✓	✓
White Discharge	✓	✓	✓	✓
Flash Ageing	—	×	✓	×
Remarks	May be printed from strongly alkaline pastes Oxidn. with bichromate does not alter the hue	Direct prints developed by chlorate or nitrite	Direct print fixation improved by 20% increase in sodium sulphoxylate-formaldehyde	Direct prints developed by chlorate or nitrite
FASTNESS				
Testing Method	ISO		AATCC	ISO
Cross Dyeing	—		5	5
Hot Pressing	—		4	3
Hypochlorite	5		5	5
Light	4, 5, 6		5–6, 6, 6–7	6, 6–7, 7
Mercerising	5		4	4
Peroxide Bleach	5		4–5	4–5
Soda Boil	—		4–5	4–5
Soda Boil (Hypochlorite)	—		4–5	4–5
Washing Alteration	4		—	5
Staining	—		—	5
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON		SILK: Dye weakly acid adding sodium sulphoxylate-formaldehyde Develop by bichromate WOOL: Dye weakly acid Develop by bichromate FASTNESS WOOL (ISO): Light 5–6, 6, 6–7 Milling 4–5 Washing 5	VISCOSE: Dyed weaker and bluer at low temperatures and slightly bluer at high temperatures. For data on strike, see *JSDC*, **55** (1939), 496 SILK: Low substantivity UNIONS: Good solidity on cotton/viscose, dyed cold Viscose dyed yellower and heavier than cotton at 50°C	SILK: Dye weakly acid Develop by bichromate FASTNESS SILK (ISO): Degumming 3–4 Light 6, 6–7, 6–7 Peroxide 5 Washing 5 WOOL: Dye weakly acid Develop by bichromate FASTNESS WOOL (ISO): Light 8, 8, 8 Milling 4–5 Washing 4–5
NON-TEXTILE USAGE			See C.I. Pigment Red 196	

11	Solubilised 11	12	13	C.I. Vat Red
Indigoid	Indigoid	Anthraquinone	70320	C.I. Constitution Number or Chemical Class
Bright Bluish Red Yellower		Bluish Red Yellower and brighter	Bluish Red Redder and brighter	Hue Artificial Light
		Dull Yellow	Yellowish Red	Reaction with conc. sulphuric acid (on cellulose)
	Low Dye neutral or weakly alkaline at 20–30°C adding NaCl Develop by nitrite, sulphocyanide or chromate	2 50 50 Dull Bluish Red Yellowish Brown High Good	1 50–60 50–60 Bluish Green Dull Violet Moderate Very good Soap thoroughly to develop the true hue Dead cotton covered moderately well	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
✓ ✓ — ✓ ✓ —	✓ — — — ✓ × Direct prints developed by nitrite, sulphocyanide or chromate	✓ — — — — —	✓ ✓ — ✓ ✓ —	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
ISO — 3–4 5 6, 6–7, 6–7 5 5 2 2 — — Accelerates tendering on exposure to light		AATCC — 3 4–5 7, 7, 8 3–4 1 — — 3 —	AATCC ISO 4 5 5 4 5 5 6–7, 7, 7–8 5, 6, 6 4 4–5 4–5 5 5 4–5 — 4–5 — 5 — 5 Accelerates tendering on exposure to light	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
	SILK: Dye neutral or weakly acid Substantivity, high. Develop by sulphocyanide/bichromate FASTNESS SILK (ISO): Degumming 3 Light 4, 5–6, 6 Peroxide 4–5 Washing 4–5 WOOL: Suitable but of limited interest	SILK: Suitable WOOL: Suitable	SILK: Substantivity, moderate; levelling, good FASTNESS SILK (ISO): Degumming 3–4 Light 5, 6, 7 Peroxide 5 Washing 5 WOOL: Suitable FASTNESS WOOL (AATCC): Light 5, 6, 7 Milling (III) 3 Washing (II) 2–3	**TEXTILE APPLICATION OTHER THAN COTTON**
		PLASTICS	See C.I. Pigment Red 195	**NON-TEXTILE USAGE**

C.I. Vat Red	14	15	16	17
C.I. Constitution Number or Chemical Class	71110	71100	Anthraquinone	Anthraquinone
Hue Artificial Light	Dull Yellowish Red Yellower and brighter	Dull Red Brighter	Bluish Red Yellower	Yellowish Red Yellower and brighter
Reaction with conc. sulphuric acid (on cellulose)	Yellowish Red		Orange	Reddish Violet
DYEING				
Method	1	1, (1+, 2)	1	2, (1)
Vatting Temp. °C	50–60	60	60	45–50
Dyeing Temp. °C	50–60	60	50–60	45–50
Leuco Alkaline	Olive	Brown*	Bluish Green	Blue
Acid	Blue*	Orange	Dull Violet	Dull Reddish Orange
Substantivity	Moderate	High	High	High
Levelling	Good	Very good	Good	Good
Remarks	Soap thoroughly to develop the true hue Dead cotton covered moderately well *Green fluorescence	Dead cotton covered well *Green fluorescence	Soap thoroughly to develop the true hue	
PRINTING				
Direct	✓	✓	✓	✓
Coloured Resist	✓	✓	—	✓
White Resist	—	—	—	—
Coloured Discharge	✓	✓	—	✓
White Discharge	✓	✓	✓	×
Flash Ageing	—	—	—	—
Remarks			Dischargeable in pale dyeings only	
FASTNESS				
Testing Method	AATCC / ISO	ISO	AATCC	AATCC
Cross Dyeing	— / Good	Good	—	—
Hot Pressing	5 / 4–5	4–5	3	5
Hypochlorite	— / 5	4–5	5	4–5
Light	6, 6–7, 7 / 6, 6–7, 6–7	6, 6, 6–7	6, 6–7, 7	—, 5–6, —
Mercerising	5 / 4–5	3	4	4
Peroxide Bleach	5 / 3	3	4	3
Soda Boil	— / 3–4	3–4	—	—
Soda Boil (Hypochlorite)	— / Suitable	Suitable	—	—
Washing Alteration	5 / 4–5	4–5	—	—
Staining	5 / 5	4–5	—	—
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON	VISCOSE: For data on strike, see *JSDC*, **55** (1939), 496 SILK: Unsuitable WOOL: Unsuitable	UNIONS: Good solidity on cotton/viscose	WOOL: Suitable FASTNESS WOOL (AATCC): Light 5, 5–6, 6 Milling (III) 3 Washing (II) 3–4	
NON-TEXTILE USAGE	PAPER: Stock colouration	See C.I. Pigment Red 194		

18	19	20	21	C.I. Vat Red
60705	64015	67100	61670	C.I. Constitution Number or Chemical Class
Bordeaux Brighter and yellower	Bluish Red Yellower	Bluish Red→Reddish Violet Yellower	Dull Bluish Red Brighter and yellower	Hue Artificial Light
	Yellow	Dull Yellow		Reaction with conc. sulphuric acid (on cellulose)
2, (3) 50 45–50 Olive Brownish Olive High Very good The true hue is readily developed on soaping	2, (3) 50 25 Reddish Violet Yellowish Red High Very good Owing to oxidation difficulties, avoid open vat dyeing	2, (1, 3) 60–70 45–50 Brownish Olive Orange High Very good	2, (1, 3) 50 45–50 Reddish Brown Yellowish Brown Moderate Very good Dead cotton covered moderately well When dyeing by method 1 add NaCl	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
✓ ✓ — ✓ ✓ —	× × — × ✓ —	✓ ✓ — ✓ ✓ —	✓ ✓ — ✓ ✓ —	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
ISO Fairly good 3–4 4 6, 6–7, 7 4 4 4 Suitable 4–5 5 Sensitive to nitrous acid	ISO 4 3–4 4–5 7, 7, 7–8 5 4 2–3 2–3 4 4–5	ISO Fairly good 4–5 5 6–7, 7, 7 5 4–5 4–5 Suitable 4–5 5	ISO 5 3 5 6–7, 7, 7 4 5 4–5 4–5 5 4–5	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
SILK: Moderately suitable FASTNESS SILK (ISO): Degumming 3–4 Light 6–7, 7, 7 Peroxide 5 Washing 5	VISCOSE: Best dyed by method 2 at 50°C. For data on strike see *JSDC*, **55** (1939), 496 Barry viscose covered SILK: Suitable FASTNESS SILK (ISO): Degumming 5; Light 5–6, Peroxide 4; Washing 5 UNIONS: Cotton/viscose, viscose dyed heavier than cotton	VISCOSE: For data on strike, see *JSDC*, **55** (1939), 496 SILK: Suitable FASTNESS SILK (ISO): Degumming 3–4 Light 5, 6–7, 7 Peroxide 5 Washing 5 UNIONS: Suitable for cotton/viscose and cotton/silk		**TEXTILE APPLICATION OTHER THAN COTTON**
				NON-TEXTILE USAGE

C.I. Vat Red	22	23	24	25
C.I. Constitution Number or Chemical Class	Anthraquinone	71130	Anthraquinone	Anthraquinone
Hue	Dull Bordeaux	Dull Yellowish Red	Bluish Red	Bordeaux
Artificial Light	Brighter and yellower	Yellower	Yellower	Yellower
Reaction with conc. sulphuric acid (on cellulose)	Dull Brown	Bluish Red	Dull Red	
DYEING				
Method	2, (1)	2, (3)	2, (1)	2, (3)
Vatting Temp. °C	60	50	40–50	50
Dyeing Temp. °C	60	45–50	40–50	50
Leuco Alkaline	Reddish Brown	Reddish Violet	Bluish Red	Reddish Brown
Acid	Brown	Dull Orange	Orange	Orange
Substantivity	—	Moderate	High	—
Levelling	—	Good	Good	Good
Remarks	Method 1, requiring an addition of NaCl, is suitable for shading only		Method 1 suitable for shading only For data on strike, levelling and migration, see *JSDC*, **66** (1950), 505	Method 3 is suitable for shading only
PRINTING				
Direct		✓	×	×
Coloured Resist		×	×	×
White Resist		—	—	—
Coloured Discharge		×	×	×
White Discharge		✓	✓	—
Flash Ageing		✓	✓	—
Remarks		Suitable for printing light and medium hues Sensitive to steaming conditions		
FASTNESS				
Testing Method	ISO	ISO	AATCC ISO	AATCC ISO
Cross Dyeing	—	Good	— 5	— 5
Hot Pressing	5	5	5 4	5 3–4
Hypochlorite	4–5	4–5	4–5 4–5	4 5
Light	5–6, 6, 7	6–7, 7, 7	—, 6–7, — 6, 6–7, 7	4, 5, 6 4–5, 5, 5–6
Mercerising	5	4	5 5	4 4
Peroxide Bleach	4–5	2–3	4 4–5	5 4–5
Soda Boil	4–5	Unsuitable	— 4–5	— 4–5
Soda Boil (Hypochlorite)	—	4–5	— 4–5	— 4–5
Washing Alteration	—	4	— 4–5	— 5
Staining	—	—	— 5	— 5
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON	SILK: Suitable	VISCOSE: Dyes weaker and duller when applied cold, and sl. duller at high temp. For data on strike, rate of diffusion and time of half-dyeing see *JSDC*, **55** (1939), 481 SILK: Substantivity, poor UNIONS: Good solidity on cotton/viscose dyed cold Viscose dyes heavier than cotton at 50°C	VISCOSE: Best dyed at 80°C. At lower temperatures, weaker dyeings result. For data on strike, rate of diffusion and time of half-dyeing, see *JSDC*, **55** (1939) 481 SILK: Suitable FASTNESS SILK (ISO): Degumming 4 Light 5, 5–6, 6 Peroxide 5 Washing 5	SILK: Suitable
NON-TEXTILE USAGE		See C.I. Pigment Red 179		

26	27	28	29	30	C.I. Vat Red
73340 Yellowish Red Yellower		**65710** Yellowish Red Yellower	**71140** Red Yellower and brighter	**56065** Bluish Red	C.I. Constitution Number or Chemical Class Hue Artificial Light
Blue		Yellowish Red	Blue		Reaction with conc. sulphuric acid (on cellulose)
2 60–70 50–60 Yellow Colourless High Good	This C.I. Generic Name is discontinued	2, (3) 40–50 40–50 Reddish Orange Yellow — — Method 3 suitable for shading only	2, (1) 50 45–50 Reddish Violet Dull Reddish Brown Moderate Moderate When dyeing by method 1 add NaCl Dead cotton covered moderately well	4 Dull Bordeaux	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
√ √ — √ — —		√ √ — × √ — Suitable only for direct printing from strongly alkaline pastes	√ √ — √ √ —		**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
ISO Suitable 4–5 4–5 4, 4–5, 6 4–5 4–5 3–4 Suitable — —		AATCC ISO — 4–5 5 3–4 5 5 —, 5–6, — 5, 5–6, 6 5 5 4 4–5 — 4 — 4 — 4 — 4–5	AATCC ISO 4 Good 4 4 5 5 6, 6–7, 7 5–6, 6, 6–7 4 4 3–4 3–4 4 3–4 — Suitable — 4–5 — 5		**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
SILK: Suitable FASTNESS SILK (ISO): Light 4 Washing 4 WOOL: Suitable		SILK: Suitable	SILK: Suitable FASTNESS SILK (ISO): Degumming 4 Light 7, 7, 7 Peroxide 4 Washing 5	WOOL: Suitable FASTNESS WOOL (ISO): Milling 5 Light 6 Stoving 4–5 Washing 5	**TEXTILE APPLICATION OTHER THAN COTTON**
			See C.I. Pigment Red 190		**NON-TEXTILE USAGE**

C.I. Vat Red	31	32	32:1	33
C.I. Constitution Number or Chemical Class	—	71135		56050
Hue Artificial Light	Bluish Red Yellower and brighter	Red Yellower		Dull Bluish Red Yellower
Reaction with conc. sulphuric acid (on cellulose)		Violet		
DYEING				
Method	2, 3, (1)	2, (1)		4
Vatting Temp. °C	45–50	50		60
Dyeing Temp. °C	45–50 (Method 2), 20–25 (Method 3)	45–50		50–60
Leuco Alkaline	Bordeaux	Reddish Violet		Reddish Yellow
Acid	Yellowish Brown	Reddish Orange		Pale Yellow
Substantivity	Fairly high	Moderate		High
Levelling	Good	Moderate		Very good
Remarks			USAGE/PROPERTIES: Similar to C.I. Vat Red 32 Slightly different chemically	
PRINTING				
Direct	√	√		×
Coloured Resist	√	√		×
White Resist	—	—		—
Coloured Discharge	√	√		×
White Discharge	√	—		—
Flash Ageing	—	—		—
Remarks	Dischargeable to white in pale and medium hues			
FASTNESS				
Testing Method	ISO	AATCC ISO		
Cross Dyeing	5	— Suitable		
Hot Pressing	5	5 4		
Hypochlorite	5	4–5 3		
Light	6–7, 7, 7–8	5–6, 6, 7 —, 5, 6		
Mercerising	4–5	4 4		
Peroxide Bleach	5	4 Suitable		
Soda Boil	4–5	3–4 3–4		
Soda Boil (Hypochlorite)	5	3–4 Suitable		
Washing Alteration	4	— —		
Staining	5	— —		
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON	SILK: Suitable. Dyes slightly yellower than on cotton FASTNESS SILK (ISO): Degumming 4–5 Light 6–7, 6–7, 7 Peroxide 5 Washing 5 UNIONS: Cotton dyed bluer than viscose in cotton/viscose			WOOL: Substantivity, high; levelling, very good FASTNESS WOOL (ISO): Light 4–5, 5, 6 Milling 5 Peroxide 4–5 Stoving 4–5 Washing 5 SILK: Substantivity, good
NON-TEXTILE USAGE		See C.I. Pigment Red 189		

34	Solubilised 34	35	36	C.I. Vat Red
70330	70331	68000	Indigoid	C.I. Constitution Number or Chemical Class
Bluish Red Yellower		Dull Red Yellower and brighter	Bright Bluish Pink Yellower	Hue Artificial Light
		Reddish Yellow	Bluish Red	Reaction with conc. sulphuric acid (on cellulose)
2, 3, (1) 50 40–50 Greenish Blue Violet — — Method 1 is suitable for shading only		3, (2) 30 25 Bluish Red Dull Orange Fairly high Very good Protect unoxidised dyeings from direct sunlight Accelerate slow oxidation with acid bichromate For report on strike, see *JSDC* **66** (1950), 505	2, 4, (1, 3) 80–90 40–50 Reddish Yellow Colourless — — Air oxidation after dyeing is necessary	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
✓ — — — ✓ — Best printed from strongly alkaline pastes	✓ — — — ✓ × Good yield in printing on cellulose Also suitable for wool and silk	✓ ✓ — ✓ ✓ —	✓ ✓ — ✓ ✓ — Oxidation by peroxide preferable, as bichromate dulls the hue	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
ISO 5 3 5 5, 6, 6 4 5 4–5 4–5 4–5 5		AATCC ISO 4–5 5 4–5 4–5 5 5 6–7, 7–8, 8 7–8, 8, 8 4 5 4 4 4 3 — 3 — 3 — 4–5	ISO 5 5 5 4–5, 5, 6 3 5 4–5 4–5 4 5 Accelerates tendering on exposure to light	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
SILK: Suitable	SILK: Suitable WOOL: Suitable	VISCOSE: For data on strike, rate of diffusion and time of half-dyeing, see *JSDC*, **55** (1939) 481 SILK: Substantivity, poor WOOL: Suitable FASTNESS WOOL (AATCC): Light 5–6; Milling 4 Washing 3–4 UNIONS: Viscose dyed heavier than cotton on viscose/cotton	SILK: Suitable FASTNESS SILK (ISO): Degumming 4 Light 4–5, 5, 6 Peroxide 5 Washing 4–5 WOOL: Suitable	**TEXTILE APPLICATION OTHER THAN COTTON**
				NON-TEXTILE USAGE

C.I. Vat Red	37	38	39	40
C.I. Constitution Number or Chemical Class	**59310** (Main component)	**67810**	**67900**	**68300**
Hue Artificial Light	Yellowish Red Yellower	Bluish Pink Yellower	Bright Bluish Pink Yellower and brighter	Bright Red Yellower
Reaction with conc. sulphuric acid (on cellulose)	Yellowish Green			Yellowish Red
DYEING				
Method	3, (2)	3, (2)	3	3, (2)
Vatting Temp. °C	45–50	45 (Short liquor)	20–25	50
Dyeing Temp. °C	25–30	20–25	20–25	20–25
Leuco Alkaline	Reddish Violet	Bordeaux	Violet	Reddish Brown
Acid	Yellow	Dull Orange	Bluish Red	Orange
Substantivity	Low	Moderate	Moderately high	High
Levelling	Very good	Very good	Very good	Very good
Remarks	Soap thoroughly to develop the true hue Dead cotton covered moderately well		For deep shades increase NaOH by 40% Protect unoxidised dyeings from direct sunlight	Protect unoxidised dyeings from direct sunlight Soap thoroughly to develop the true hue
PRINTING				
Direct	✓	✓	×	✓
Coloured Resist	✓	✓	×	✓
White Resist	—	—	✓	—
Coloured Discharge	✓	✓	×	✓
White Discharge	✓	✓	✓	✓
Flash Ageing	—	—	—	—
Remarks			Dischargeable to white in pale hues	
FASTNESS				
Testing Method	ISO	ISO	ISO	ISO
Cross Dyeing	4	Good	Very good	Good
Hot Pressing	4	5	4	4
Hypochlorite	5	5	5	5
Light	7–8, 7–8, 8	6–7, 7, 7–8	7–8, 7–8, 8	7, 7–8, 7–8
Mercerising	4–5	4	5	4
Peroxide Bleach	4	4–5	4–5	4
Soda Boil	3–4	3	2–3	3–4
Soda Boil (Hypochlorite)	3–4	Unsuitable	Unsuitable	Suitable
Washing Alteration	4–5	4–5	4–5	4–5
Staining	5	5	5	4–5
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON	VISCOSE: For data on strike, see *JSDC*, **55** (1939), 406	SILK: Suitable FASTNESS SILK (ISO): Degumming 3 Light 6–7, 7, 7 Peroxide 5 Washing 5	UNIONS: Good solidity on cotton/viscose SILK: Not suitable WOOL: Not suitable	SILK: Suitable FASTNESS SILK (ISO): Degumming 2–3 Light 7, 7, 7–8 Peroxide 5 Washing 5
NON-TEXTILE USAGE	PAPER: Stock colouration		PAPER: Stock colouration	

41	42	43	44	C.I. Vat Red
73300	61650	Anthraquinone	Anthraquinone	C.I. Constitution Number or Chemical Class
Bluish Red Yellower and brighter	Yellowish Red Yellower and brighter	Pink Slightly Yellower	Bright Bluish Pink Yellower	Hue Artificial Light
Green	Red	Brown		Reaction with conc. sulphuric acid (on cellulose)
4 50–60 30–40 Reddish Yellow Pale Yellow Poor Fairly good	3 50 20–25 Dull Reddish Violet Yellowish Brown Moderate Very good Protect unoxidised dyeings from direct sunlight	3 ≯30–35 20–25 Dull Blue Orange Moderate Good Dead cotton covered moderately well Not suitable for oxidation with acid bichromate	3, (2) 40–50 25–30 Dark Brown Pale Orange — — Soap thoroughly to develop the true hue	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
✓ ✓ — ✓ ✓ — Oxidation by peroxide preferable as bichromate dulls the hue	× × — × ✓ —	✓ ✓ — ✓ ✓ —	✓ ✓ — ✓ ✓ – Avoid strongly alkaline printing pastes	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
AATCC ISO — 2 5 4 5 3 —, 5–6, — 4, 4–5, 5–6 5 4–5 5 2 — 1 — 1 — — — —	ISO 5 3–4 5 6, 7, 7–8 5 4 4 4 3–4 4 Accelerates tendering on exposure to light	ISO 5 5 4–5 6–7, 7, 7–8 Bluer 5 2 2 — —	AATCC ISO — 4–5 5 4 4–5 5 —, 6–7, — 5, 6, 6–7 3 3 4–5 4–5 — 3–4 — 3–4 — 4 — 5	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
SILK: Substantivity, high; levelling, good FASTNESS SILK (ISO): Degumming 1; Light 7 Peroxide 5; Stoving 3 Washing 4 WOOL: Substantivity, high; levelling, very good FASTNESS WOOL (ISO): Light 7–8, 7–8, 8 Milling 5; Peroxide 5 Washing 5	VISCOSE: Best dyed at 50°C. For data on strike, rate of diffusion and time of half-dyeing, see *JSDC*, **55** (1939), 481 SILK: Poor substantivity UNIONS: Good solidity on cotton/viscose dyed cold Viscose dyed slightly heavier than cotton at 50°C	VISCOSE: Very low substantivity when dyed cold Best dyed at 50°C UNIONS: Good solidity on cotton/viscose at low temperatures. Viscose dyed much heavier than cotton at 50°C	VISCOSE: Dyes equally well when applied by methods 2 or 3	**TEXTILE APPLICATION OTHER THAN COTTON**
	PAPER: Stock colouration			**NON-TEXTILE USAGE**

C.I. Vat Red	45	Solubilised 45	46	47
C.I. Constitution Number or Chemical Class	73860	73861	Anthraquinone	73305
Hue Artificial Light	Bright Pink→Bright Yellowish Red Yellower		Pink Yellower	Bluish Pink→Bluish Red Yellower
Reaction with conc. sulphuric acid (on cellulose)	Green			Green
DYEING				
Method	4		3, (2)	4
Vatting Temp. °C	40–50		40–50	65–75
Dyeing Temp. °C	40–50		25–30	40–50
Leuco Alkaline	Reddish Violet		Reddish Grey	Yellow
Acid	Orange		—	Pale Yellow
Substantivity	Moderate		—	High
Levelling	Good		Good	Good
Remarks	Substantivity improved by adding NaCl		Soap thoroughly to develop the true hue	
PRINTING				
Direct	√		√	√
Coloured Resist	√		√	√
White Resist	—		—	√
Coloured Discharge	√		√	√
White Discharge	×		√	√
Flash Ageing	—		—	—
Remarks	Owing to slow oxidation allow prints to hang several days. Complete oxidation with peroxide and ammonia or perborate		Direct printing yield improved by adding anthraquinone	Avoid strongly alkaline pastes. Peroxide oxidation preferable as bichromate causes dulling
FASTNESS				
Testing Method	ISO		ISO	ISO
Cross Dyeing	3–4		5	4–5
Hot Pressing	4		5	4
Hypochlorite	4		5	4
Light	4–5, 5, 6		5–6, 6–7, 7	5, 5–6, 6–7
Mercerising	4–5		3	5
Peroxide Bleach	3		5	3–4
Soda Boil	2		4–5	3
Soda Boil (Hypochlorite)	2		Suitable	2–3
Washing Alteration	1		4–5	4–5
Staining	4–5		5	5
Remarks	Accelerates tendering on exposure to light			Accelerates tendering on exposure to light
TEXTILE APPLICATION OTHER THAN COTTON	VISCOSE: Barry viscose covered well WOOL: Substantivity, high FASTNESS WOOL (ISO): Light 5, 5, 4 Milling 4 Peroxide 4 Stoving 4 Washing 5		UNIONS: Good solidity on cotton/viscose	SILK: Suitable FASTNESS SILK (ISO): Degumming 4 Light 7, 7–8, 7–8 Peroxide 4–5 Washing 5 WOOL: Suitable FASTNESS WOOL (ISO): Peroxide 5 Stoving 5 Washing 5
NON-TEXTILE USAGE				

48	49	50	51	C.I. Vat Red
65205	Anthraquinone	Anthraquinone	Anthraquinone (acylamino derivative)	C.I. Constitution Number or Chemical Class
Dull Yellowish Red Brighter	Bluish Red Yellower	Bluish Pink Brighter	Red Yellower	Hue Artificial Light
Greyish Green	Blue and Brown		Brown	Reaction with conc. sulphuric acid (on cellulose)
3, (2) 50 20–25 Reddish Brown Olive Brown High Very good For method 3, reduce NaOH by 20% Protect unoxidised dyeings from direct sunlight	2, (3) 50 40–50 Red Yellow Brown High Very good Dead cotton covered moderately well	2, (1, 3) 50 60 Dark Bordeaux Orange Brown High Good Dead cotton covered moderately well	1, (2) 50 30–50 Reddish Brown Yellowish Orange High Good When dyeing medium or deep hues, double the amount of salt Poor coverage of dead cotton	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
√ √ — √ √ —	√ √ — √ — —		√ √ — √ √ —	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
ISO Good 3–4 5 6, 6–7, 6–7 4 4–5 4 Suitable 5 5 Accelerates tendering on exposure to light	ISO 5 5 5 6, 6–7, 7 5 4–5 4–5 Suitable — —	ECE — 4–5 5 6, 6–7, 7 4–5 5 5 — 4–5 5	ECE 5 4 4–5 6–7, 7, 7–8 4–5 4–5 4–5 Suitable 4–5 5	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
				TEXTILE APPLICATION OTHER THAN COTTON
				NON-TEXTILE USAGE

C.I. Vat Red	52	53	54	55
C.I. Constitution Number or Chemical Class	Anthraquinone	Anthraquinone	Anthraquinone	Amino ketone
Hue Artificial Light	Yellowish Pink Yellower and brighter	Pink Yellower and brighter	Bright Red	Bright Yellowish Red
Reaction with conc. sulphuric acid (on cellulose)	Pale Dull Yellow	Yellow	Dull Yellow	Dull Yellow
DYEING				
Method	2, (3)	3	1	
Vatting Temp. °C	50–60	60	70	
Dyeing Temp. °C	50–60	60	45–60	
Leuco Alkaline	Reddish Brown	Yellowish Brown	Bordeaux	
Acid	Yellowish Brown	Yellow	Yellowish Red	
Substantivity	High	High	High	
Levelling	Good	Good	Good	
Remarks			Dead cotton covered well	
PRINTING				
Direct	✓	×	×	✓
Coloured Resist	—	×	×	✓
White Resist	—	—	—	—
Coloured Discharge	—	×	×	✓
White Discharge	—	—	—	—
Flash Ageing	—	—	✓	—
Remarks	Suitable for direct printing in pale hues			
FASTNESS				
Testing Method	AATCC	AATCC	ECE	ECE
Cross Dyeing	—	—	4–5	—
Hot Pressing	5	5	4	4
Hypochlorite	4	4–5	4	5
Light	—, 6–7, —	—, 7–8, —	6–7, 6–7, 7	5, 6, 6–7
Mercerising	—	—	4	5
Peroxide Bleach	2	4–5	4–5	5
Soda Boil	—	—	4–5	4–5
Soda Boil (Hypochlorite)	—	—	Suitable	—
Washing Alteration	—	4–5	—	—
Staining	—	—	—	—
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON				
NON-TEXTILE USAGE				

56	57-59	60	61	C.I. Vat Red
Indigoid Pink Yellower and brighter		Anthraquinone Bordeaux Yellower	Thioindigoid Yellowish Red	C.I. Constitution Number or Chemical Class Hue Artificial Light
Red				Reaction with conc. sulphuric acid (on cellulose)
4 80–85 50 Yellow — Moderate Very good Requires special process for stock vat reduction, and care to prevent loss of dye before oxidation is complete	These C.I. Generic Names are discontinued	2, (3) 50 50 Brown — High Good Dead cotton covered moderately well	4 (Special) 70–80 40–50 Yellow — — Good	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
× × — × — —		✓ ✓ — ✓ ✓ — Dischargeable to a white in pale hues	✓ ✓ — ✓ ✓ —	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
AATCC 4 4–5 5 3, 4, 5 4 5 4–5 — 4 5		ISO 4 5 4–5 6–7, 7, 7–8 4 4 4 3–4 — —	JIS — 4–5 5 4–5, 5, 5–6 4 4–5 4 — 4–5 4–5	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
VISCOSE: The hue on viscose is yellower than on cotton SILK: Substantivity, high WOOL: Substantivity, high				**TEXTILE APPLICATION OTHER THAN COTTON**
				NON-TEXTILE USAGE

C.I. Vat Violet	1	1:1	Solubilised 1	2	Solubilised 2
C.I. Constitution Number or Chemical Class	60010		60011	73385	73386
Hue Artificial Light	Bright Bluish Violet Redder			Bright Reddish Violet Redder	
Reaction with conc. sulphuric acid (on cellulose)	Green			Green	
DYEING					
Method	1, (2)			4	
Vatting Temp. °C	50–60			80	
Dyeing Temp. °C	50–60			50–60	
Leuco Alkaline	Blue			Yellow	
Acid	Reddish Violet			Colourless	
Substantivity	High		High	High	Low
Levelling	Moderate			Good	
Remarks	Dead cotton covered moderately well. For data on strike, levelling and migration, see *JSDC*, **66** (1950), 509 When dyeing by method 2, increase NaOH by 15%	Redder in hue than C.I. Vat Violet 1 Specially suitable for leuco ester production	Dye weakly alkaline at 50–80°C. Substantivity increased by adding salt but avoid excess or pptn results Develop with nitrite (cold)		Dye neutral or weakly alkaline at 20–30°C. Substantivity improved by adding salt but avoid excess or pptn results
PRINTING					
Direct	✓		✓	✓	✓
Coloured Resist	✓		✓	✓	✓
White Resist	✓		✓	✓	✓
Coloured Discharge	✓		×	✓	×
White Discharge	×		×	✓	✓
Flash Ageing	✓		×	×	×
Remarks	Peroxide oxidation preferable as bichromate causes dulling		Direct prints developed by chlorate or nitrite	Reduces easily but avoid strongly alkaline print pastes. Peroxide oxidation preferable as bichromate causes dulling	Only moderately suitable for direct printing because of low solubility. Develop with chlorate, nitrite or bichromate
FASTNESS	AATCC / ISO			AATCC / ISO	
Testing Method					
Cross Dyeing	5 / 5			5 / 5	
Hot Pressing	2 / 2			4 / 5	
Hypochlorite	4–5 / 5			5 / 5	
Light	5–6, 6–7, 7–8 / 5, 5–6, 6–7			4, 5, 6 / 4–5, 5, 6	
Mercerising	3 / 4			3–4 / 4	
Peroxide Bleach	5 / 4–5			4 / 4	
Soda Boil	5 / 4–5			5 / 3	
Soda Boil (Hypochlorite)	— / 4–5			— / 2	
Washing Alteration	— / 4–5			— / 4	
Staining	— / 4–5			— / 5	
Remarks				Accelerates tendering on exposure to light	
TEXTILE APPLICATION OTHER THAN COTTON	SILK: Substantivity, high; levelling, good FASTNESS SILK (ISO): Degumming 4 Light 5, 6, 6–7 Peroxide 5 Washing 5 WOOL: Suitable FASTNESS WOOL (AATCC): Light 5, 6, 7 Washing (III) 4–5 Milling (III) 3–4		SILK: Dye neutral or weakly alkaline at 80–90°C using Na_2SO_4. Develop by bichromate or ammonium persulphate WOOL: Weakly acid using 1% sodium sulphoxylate-formaldehyde Substantivity, high Develop with bichromate	SILK: Substantivity, high; levelling, good FASTNESS SILK (ISO): Degumming 4–5 Light 6–7, 7, 7–8 Peroxide 5 Washing 5 WOOL: Suitable FASTNESS WOOL (ISO): Light 6–7, 7, 7–8 Milling 5 Washing 5	SILK: Dye weakly acid adding sodium sulphoxylate-formaldehyde High substantivity Develop by bichromate or persulphate WOOL: Dye weakly acid. High substantivity. Develop by bichromate using more than normal
NON-TEXTILE USAGE	See C.I. Pigment Violet 31			See C.I. Pigment Violet 36	

C.I. Vat Violet	3	Solubilised 3	4	Solubilised 4
C.I. Constitution Number or Chemical Class	73395	73396	73400	73401
Hue Artificial Light	Bright Reddish Violet Redder and brighter		Violet Redder	
Reaction with conc. sulphuric acid (on cellulose)	Reddish Violet			
DYEING				
Method	4		4	
Vatting Temp. °C	85		70	
Dyeing Temp. °C	50–60		50	
Leuco Alkaline	Yellow		Reddish Yellow	
Acid	Colourless		Yellow	
Substantivity	High	Moderate	High	Moderate
Levelling	Good to very good		Good	
Remarks		Dye weakly alkaline at 60°C Develop with nitrite Applicable by the one-bath method, develop at 60–70°C		Dye neutral or weakly alkaline at 20–30°C Exhaustion increased by adding salt Develop by nitrite (hot or cold)
PRINTING				
Direct	✓	✓	✓	✓
Coloured Resist	✓	✓	✓	✓
White Resist	✓	✓	—	✓
Coloured Discharge	✓	—	✓	×
White Discharge	✓	✓	✓	✓
Flash Ageing	✓	×	—	×
Remarks	In direct printing increased amounts of sodium sulphoxylate-formablehyde improve colour yield. Peroxide oxidation preferred as bichromate causes dulling	Direct prints developed by chlorate or nitrite	In direct printing soda ash may replace potash, but avoid NaOH Peroxide oxidation preferable as bichromate causes dulling	Direct prints developed by chlorate, nitrite or bichromate
FASTNESS				
Testing Method	AATCC	ISO	ISO	
Cross Dyeing	5	5	4–5	
Hot Pressing	5	4	4–5	
Hypochlorite	5	5	4–5	
Light	4, 5, —	4, 5, 5–6	5, 5–6, 6–7	
Mercerising	3–4	3	4	
Peroxide Bleach	4	4	4	
Soda Boil	4–5	4	3	
Soda Boil (Hypochlorite)	—	4–5	3–4	
Washing Alteration	—	4–5	4–5	
Staining	—	5	5	
Remarks	Accelerates tendering on exposure to light			
TEXTILE APPLICATION OTHER THAN COTTON	SILK: Substantivity, moderate; levelling, good FASTNESS SILK (ISO): Degumming 4–5 Light 5, 6, 7 Peroxide 5 Washing 5	SILK: Dye weakly acid, develop by bichromate WOOL: Neutral or weakly acid, develop by bichromate FASTNESS WOOL (AATCC): Light 5 Milling (III) 3 Peroxide 4–5 Stoving 4 Washing (III) 3	SILK: Suitable FASTNESS SILK (ISO): Degumming 3 Light 5–6 Peroxide 4–5 WOOL: Suitable FASTNESS WOOL (ISO): Light 8 Milling 4–5 Washing 5	SILK: Dye weakly acid adding sodium sulphoxylate-formaldehyde. Substantivity, high Develop by bichromate WOOL: Dye weakly acid adding ammonium sulphate Substantivity high; levelling, good. Develop by bichromate ACETATE: Dye strongly acid adding sodium sulphoxylate-formaldehyde
NON-TEXTILE USAGE	See C.I. Pigment Violet 38			

5	Solubilised 5	Solubilised 6	Solubilised 7	C.I. Vat Violet
73595	73596	59316	59321	C.I. Constitution Number or Chemical Class
Bluish Violet Much redder		Reddish Violet Redder	Violet Redder	Hue Artificial Light
Bluish Green				Reaction with conc. sulphuric acid (on cellulose)
4 70–80 50 Golden Yellow Pale Yellow High Good Dead cotton covered moderately well	Fairly high Dye neutral or weakly alkaline at 20–30°C Add salt for exhaustion Develop by nitrite (hot)	Moderately high Dye neutral using Na_2SO_4, avoid excess or pptn may result. Develop by nitrite Applicable by the one-bath method	Moderately high Dye neutral using Na_2SO_4 Develop by nitrite Applicable by the one-bath method	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
✓ ✓ — ✓ ✓ —	✓ ✓ ✓ × ✓ × Direct prints develped by chlorate, nitrite or bichromate	✓ ✓ ✓ — ✓ × Direct prints developed by chlorate, nitrite or bichromate	✓ ✓ ✓ × ✓ × Direct prints developed by chlorate, nitrite or bichromate	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
ISO Suitable 3–4 4–5 5, 5–6, 6 4 3–4 3 Suitable — —		ISO Good 4–5 4–5 6–7, 7, — 4–5 5 3–4 Suitable — —	ISO Good 4–5 4–5 6, 6–7, — 4–5 5 3–4 Suitable — —	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
VISCOSE: Dyes redder than cotton. For data on strike, rate of diffusion and time of half-dyeing, ses *JSDC*, 55 (1939) 481 SILK: Suitable FASTNESS SILK (ISO): Degumming 3 Light 5, 5–6, 6 WOOL: Suitable FASTNESS WOOL (ISO): Milling 4–5 Light 8 Washing 5	SILK: Dye weakly acid using sodium sulphoxylate-formaldehyde Develop by bichromate WOOL: Dye weakly acid using ammonium sulphate. High substantivity Develop by bichromate	SILK: Dye weakly acid using sodium sulphoxylate-formaldehyde Develop by bichromate	SILK: Weakly acid bath using sodium sulphoxylate-formaldehyde Develop by bichromate	**TEXTILE APPLICATION OTHER THAN COTTON**
				NON-TEXTILE USAGE

C.I. Vat Violet	Solubilised 8	9	10	11
C.I. Constitution Number or Chemical Class	73601	60005	60000	Anthraquinone
Hue Artificial Light	Bright Violet Redder	Bright Bluish Violet Redder and slightly duller	Bluish Violet Redder	Bluish Violet Redder
Reaction with conc. sulphuric acid (on cellulose)	Green	Yellowish Green	Green	Green
DYEING				
Method		1, (2)	1, (2)	1, (2)
Vatting Temp. °C		50–60	50–60	50–60
Dyeing Temp. °C		50–60	60	50–60
Leuco Alkaline		Blue	Dull Reddish Blue	Greenish Blue
Acid		Dull Bluish Red	Dull Red	Bluish Violet
Substantivity	Poor	High	High	—
Levelling		Poor	Moderate	—
Remarks	Dye neutral or weakly alkaline, add salt to exhaust Develop by nitrite (hot or cold)	When dyeing by method 2, use 15% more NaOH Sensitive to hard water	Thorough soaping necessary to develop the true hue	Rinse immediately after dyeing
PRINTING				
Direct	✓	✓	✓	✓
Coloured Resist	✓	✓	✓	✓
White Resist	✓	—	—	—
Coloured Discharge	×	✓	✓	✓
White Discharge	×	×	—	—
Flash Ageing	×	✓	—	—
Remarks	Direct prints developed by chlorate, nitrite or bichromate	Applicable in strongly alkaline pastes Do not use anthraquinone		In direct printing use of soda ash instead of potash is beneficial
FASTNESS				
Testing Method	ISO	AATCC ISO	ISO	ISO
Cross Dyeing	—	5 5	—	4–5
Hot Pressing	4	2–3 2	3	2
Hypochlorite	4	5 5	5	5
Light	5–6, 6, 6–7	5, 6, 7 5, 5–6, 6	5, 5–6, 6	4–5, 5–6, 6
Mercerising	—	3–4 4	4	5
Peroxide Bleach	—	4 4–5	4–5	5
Soda Boil	3	4 4	4	3
Soda Boil (Hypochlorite)	Unsuitable	4 4–5	—	3
Washing Alteration	—	— 4–5	—	4
Staining	—	— 5	—	5
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON	SILK: Dye weakly acid using sodium sulphoxylate-formaldehyde Develop by bichromate FASTNESS SILK (ISO): Degumming 2–3 Light 6 Peroxide 5 WOOL: Dye weakly acid adding ammonium sulphate Develop by bichromate	VISCOSE: Hue redder than on cotton. For data on strike, rate of diffusion and time of half-dyeing, see *JSDC*, **55** (1939), 481 SILK: Suitable FASTNESS SILK (ISO): Degumming 4–5 Light 5–6, 6, 6–7 Peroxide 5 Washing 5	VISCOSE: Hue considerably redder than on cotton	SILK: Suitable
NON-TEXTILE USAGE		See C.I. Pigment Violet 33	PAPER: Stock colouration	

C.I. Vat Violet

12	13	14	15	
Anthraquinone	**68700**	**67895**	**63355**	C.I. Constitution Number or Chemical Class
Bright Bluish Violet Redder	Bluish Violet Redder and duller	Reddish Violet Redder	Bluish Violet Redder	Hue Artificial Light
Dull Grey→Bluish Green	Dull Orange	Yellowish Red	Green	Reaction with conc. sulphuric acid (on cellulose)
DYEING				
2, (3)	2, (1, 3)	3, (2)	3, (2)	Method
50	50	30	60	Vatting Temp. °C
50	50	20–25	20–25	Dyeing Temp. °C
Reddish Brown	Dull Blue	Violet	Reddish Brown	Leuco
Dull Reddish Violet	Brown	Brown	Dull Red	Alkaline
High	High	High	Moderate	Acid
Good	Good	Good	Very good	Substantivity
Increase the NaOH by 33%	For data on strike, levelling and migration, see *JSDC*, **66** (1950), 505	When dyeing by method 3, decrease the NaOH by 20% Protect unoxidised dyeings from direct sunlight Complete oxidation by chrome	Acidify before soaping	Levelling Remarks
Acidify before soaping				
PRINTING				
×	✓	×	✓	Direct
×	✓	—	✓	Coloured Resist
—	—	—	—	White Resist
×	✓	×	✓	Coloured Discharge
✓	×	✓	✓	White Discharge
—	✓	—	—	Flash Ageing
Poor yield in direct printing by the all-in method				Remarks
FASTNESS				
AATCC ISO	AATCC ISO	AATCC ISO	ISO	Testing Method
— 5	5 Good	5 Good	4–5	Cross Dyeing
1 Bluer	5 5	4 4–5	4–5	Hot Pressing
2–3 4	5 5	4–5 4–5	3	Hypochlorite
6, 6, 6 6, 6–7, 7	6, 6–7, 7–8 7, 7, 7–8	6, 7, 7–8 7–8, 8, 8	5–6, 6, 7	Light
4 Redder	4 4	4 4	3	Mercerising
4 4–5	4 4	4–5 4	4	Peroxide Bleach
— 4–5	4 2	5 2–3	2–3	Soda Boil
— 3–4	— Unsuitable	— Unsuitable	3	Soda Boil (Hypochlorite)
— 4–5	— 4–5	— —	3	Washing Alteration
— 4	— 4–5	— —	4	Staining
				Remarks
TEXTILE APPLICATION OTHER THAN COTTON				
SILK: Suitable FASTNESS SILK (ISO): Degumming 3–4 Light 6–7, 6–7, 7 Peroxide 4–5 Washing 4–5	WOOL: Moderately suitable FASTNESS WOOL (AATCC): Light 5–6 Milling (III) 4–5 Washing (III) 3–4	VISCOSE: For data on strike, rate of diffusion and time of half-dyeing, see *JSDC*, **55** (1939) 481 SILK: Poor substantivity WOOL: Moderately suitable FASTNESS WOOL (AATCC): Light 4, 5, 6 Milling (III) 4 Washing (III) 4	SILK: Suitable FASTNESS SILK (ISO): Degumming 3–4 Light 5–6, 6–7, 7 Peroxide 5 Washing 5	
			PAPER: Stock colouration	**NON-TEXTILE USAGE**

C.I. Vat Violet	16	17	18	19
C.I. Constitution Number or Chemical Class	65020	63365	73605	52100
Hue Artificial Light	Dull Violet Redder	Violet Redder	Bright Bluish Violet Redder	Bluish Violet Slightly Redder
Reaction with conc. sulphuric acid (on cellulose)	Yellowish Brown	Green		
DYEING				
Method	3	3, (2)	4	
Vatting Temp. °C	35	50–60	70–80	
Dyeing Temp. °C	20–25	20–25	50	
Leuco Alkaline	Bordeaux	Reddish Brown	Yellowish Brown	
Acid	Greenish Brown	Dull Reddish Violet	—	
Substantivity	High	High	—	
Levelling	Very good	Good	—	
Remarks	For maximum yield reduce the NaOH by 20% Protect unoxidised dyeings from direct sunlight	Acidify before soaping For data on strike, levelling and migration, see *JSDC*, **66** (1950), 505		
PRINTING				
Direct	✓	×		✓
Coloured Resist	✓	×		✓
White Resist	—	—		—
Coloured Discharge	✓	×		✓
White Discharge	✓	✓		×
Flash Ageing	—	—		—
Remarks		Poor fixation in direct printing		Direct printing gives best results by use of less potash and sodium sulphoxylate-formaldehyde
FASTNESS				
Testing Method	ISO	AATCC ISO	ISO	ISO
Cross Dyeing	Good	5 4–5	—	—
Hot Pressing	3–4	3 3	—	—
Hypochlorite	4–5	3 3	4	4
Light	7, 7–8, 7–8	6–7, 7, 7–8 6, 6–7, 7	—, 5, —	4, 4–5, 5
Mercerising	5	4 3	4–5	—
Peroxide Bleach	4	3–4 4	—	—
Soda Boil	4	3 3	3–4	—
Soda Boil (Hypochlorite)	Suitable	— 3–4	—	—
Washing Alteration	4–5	— 4–5	—	4
Staining	5	— 5	—	—
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON	VISCOSE: For data on strike, see *JSDC*, **55** (1939) 481 SILK: Suitable FASTNESS SILK (ISO): Degumming 3–4 Light 6–7, 7, 7 Peroxide 5 Washing 5	VISCOSE: For data on strike, rate of diffusion and time of half-deying, see *JSDC*, **55** (1939) 481 SILK: Suitable FASTNESS SILK (ISO): Degumming 3–4 Light 6–7, 7, 7 Peroxide 5 Washing 5 WOOL: Suitable	SILK: Suitable FASTNESS SILK (ISO): Light 6–7 Peroxide 5 Washing 5 WOOL: Suitable FASTNESS WOOL (ISO): Light 7 Milling 5 Peroxide 5 Stoving 5	
NON-TEXTILE USAGE		PAPER: Stock colouration		

20	21			C.I. Vat Violet
Anthraquinone Bordeaux Yellower	Anthraquinone Bright Violet			C.I. Constitution Number or Chemical Class Hue Artificial Light
	Bluish Green			Reaction with conc. sulphuric acid (on cellulose)
2, (1, 3) 50 50 Dark Brown — High Good Not suitable for use above 70°C	3 50 35–40 Reddish Brown Reddish Brown High Very good Not suitable for covering dead cotton			**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
✓ ✓ — ✓ — —	✓ ✓ — ✓ ✓ —			**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
ISO 4 3 4–5 6, 6–7, 7 5 4 4–5 4 4 5	ISO 4–5 4–5 4 6–7, 7, 7–8 4 4 3 Unsuitable — —			**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
SILK: Suitable FASTNESS SILK (ISO): Degumming 3–4 Light 4–5, 5, 6	SILK: Suitable FASTNESS SILK (ISO): Degumming 4 Light 5–6, 6, 6–7 Peroxide 4–5 Washing 4			**TEXTILE APPLICATION OTHER THAN COTTON**
				NON-TEXTILE USAGE

C.I. Vat Blue	1	Reduced 1	Reduced 1:1	Solubilised 1
C.I. Constitution Number or Chemical Class	73000	73001	—	73002
Hue Artificial Light	Navy→Reddish Navy Redder			
Reaction with conc. sulphuric acid (on cellulose)	Bluish Green			
DYEING				
Method	4	Special*		
Vatting Temp. °C	50–60	—		
Dyeing Temp. °C	20–25	20		
Leuco Alkaline	Yellow	Yellow		
Acid	Colourless	Colourless		
Substantivity	Low	Low		Low
Levelling	Moderate	Good		
Remarks	Air oxidise, acidify and rinse before soaping Increase NaOH by 50–100% for pale hues Dead cotton covered well	*Dye by multi-dip technique except for pale hues		Dye neutral or weakly alkaline at 20–30°C. Develop by nitrite (cold). As dye is sensitive to over-development add thiourea or other protective agent Soap at 30–40°C
PRINTING				
Direct	✓			✓
Coloured Resist	✓			✓
White Resist	✓			✓
Coloured Discharge	✓			×
White Discharge	✓			✓
Flash Ageing	—			—
Remarks				Direct prints developed by chlorate or nitrite

FASTNESS	AATCC	ISO
Testing Method	—	2
Cross Dyeing	3	4
Hot Pressing	1–2	2
Hypochlorite	—, 3, —	3, 3, 3–4
Light	—	4
Mercerising	2–3	2–3
Peroxide Bleach	—	1
Soda Boil	—	1
Soda Boil (Hypochlorite)	—	—
Washing Alteration	—	—
Staining		
Remarks		

TEXTILE APPLICATION OTHER THAN COTTON	WOOL: Vat with minimum NaOH, and set bath with ammonia and hydrosulphite. Also dyed by hydrosulphite-soda, bisulphite-zinc-lime or fermentation processes. Deep shades by repeated dips FASTNESS WOOL (ISO): Light 6–7, 7, 7–8, 8 Milling 5 Peroxide 5 Stoving 5 Washing 4–5	VISCOSE: Rarely used. Barry viscose covered moderately well UNIONS: Good solidity on cotton/viscose	WOOL: Especially suitable, being of low alkali content SILK: Especially suitable	WOOL: Dye weakly acid adding H_2SO_4 to exhaust Substantivity high Develop by nitrite or bichromate at 20–25°C
NON-TEXTILE USAGE	See C.I. Pigment Blue 66			

C.I. Vat Blue	2	Solubilised 2	3	Solubilised 3
C.I. Constitution Number or Chemical Class	73045	73046	73055	73056
Hue Artificial Light	Greenish Blue Greener		Reddish Blue→Reddish Navy Redder	
Reaction with conc. sulphuric acid (on cellulose)	Bluish Green		Bluish Green	
DYEING				
Method	4		4	
Vatting Temp. °C	50–55		55–65	
Dyeing Temp. °C	50–55		50	
Leuco Alkaline	Yellowish Brown		Yellow	
Acid	Colourless		Colourless	
Substantivity	High	Low	Moderately high	Poor
Levelling	Good		Moderately good	
Remarks	Increase NaOH by 50% Soap thoroughly to develop the true hue Dead cotton covered well	Dye neutral or weakly alkaline at 20–30°C Substantivity improved by adding NaCl Develop by nitrite	Air oxidise, acidify and rinse, prior to soaping Zinc-lime or ferrous sulphate process also used Dead cotton covered well	Dye neutral or weakly alkaline at 20–30°C Substantivity improved by adding NaCl Develop by nitrite (hot or cold). Add thiourea to prevent over-development
PRINTING				
Direct	✓	✓	✓	✓
Coloured Resist	✓	✓	✓	✓
White Resist	✓	✓	✓	✓
Coloured Discharge	✓	×	✓	×
White Discharge	✓	✓	✓	✓
Flash Ageing	—	—	—	×
Remarks		Direct prints developed by nitrite or bichromate or by chlorate and diethyltartrate		Direct prints developed by nitrite
FASTNESS				
Testing Method	ISO		ISO	
Cross Dyeing	Fairly good		4	
Hot Pressing	4–5		4	
Hypochlorite	3		2	
Light	3, 3–4, 4		3, 3–4, 4	
Mercerising	3		4	
Peroxide Bleach	2–3		3–4	
Soda Boil	2		2	
Soda Boil (Hypochlorite)	Unsuitable		2	
Washing Alteration	—		—	
Staining	—		—	
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON	SILK: Suitable FASTNESS SILK (ISO): Degumming 3 Light 4–5, 5, 5–6 Peroxide 4, Washing 4 WOOL: Suitable FASTNESS WOOL (ISO): Milling 5 Light 7, 7–8, 7–8 Peroxide 5 Stoving 5 Washing 5	SILK: Dye weakly acid adding sodium sulphoxylate-formaldehyde Substantivity, high Develop by bichromate WOOL: Dye weakly acid adding ammonium sulphate. Substantivity, high Develop by bichromate	WOOL: Vat with minimum NaOH, and set dyebath with ammonia and hydrosulphite adding glue or other protective agent FASTNESS WOOL (ISO): Light 7, 7–8, 7–8 Milling 5 Peroxide 5 Stoving 5 Washing 5	WOOL: Weakly acid bath, exhaust with sulphuric acid Develop with nitrite at 50°C
NON-TEXTILE USAGE	RUBBER: Mass colouration			

4	4:1	Solubilised 4	5	5:1	Solubilised 5	C.I. Vat Blue
69800		69801	73065		73066	C.I. Constitution Number or Chemical Class
Bright Reddish Blue Redder			Blue Slightly Redder			Hue Artificial Light
Greenish Brown			Bluish Green			Reaction with conc. sulphuric acid (on cellulose)
1 50–60 (Long liquor) 50–60 Blue Reddish Blue High Moderate Rinse immediately after dyeing. Air oxidation gives duller greener blues Thorough soaping (+soda) is necessary. Shade change due to over-oxidation corrected by rinsing with hydrosulphite solution	Purified form of C.I. Vat Blue 4	Poor Dye neutral or weakly alkaline Develop by nitrite Sensitive to over-development	4, (2) 60–80 50–60 Yellow Pale Yellow High Good Thorough soaping necessary to develop the true hue	USAGE/PROPERTIES: Similar to C.I. Vat Blue 5 Slightly different chemically	Moderately high Dye neutral or weakly alkaline at 20–30°C Substantivity improved by adding NaCl Develop by nitrite	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
✓ ✓ — ✓ × ✓ Use less sodium sulphoxylate-formaldehyde Urea or sodium benzyl sulphanilate (not anthraquinone) improves yield		✓ ✓ ✓ × × × Direct prints developed by nitrite	✓ ✓ ✓ ✓ ✓ ✓ Oxidation by peroxide preferable as bichromate causes dulling		✓ ✓ ✓ × ✓ × Direct prints developed by chlorate, nitrite, or bichromate	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
AATCC / ISO 4 / 3 5 / 5 2 / 1 7–8, 7–8, 8 / 7–8, 7–8, 8 2–3 / 2 4–5 / 4–5 4 / 4 — / 1 — / 4–5 — / 5			AATCC / ISO 5 / 5 5 / 5 2 / 2 3–4, 4–5, 5 / 4, 4–5, 5 3–4 / 4 4 / 3–4 3–4 / 2 — / 2 — / 4–5 — / 5			**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
VISCOSE: For data on strike, see *JSDC*, **55** (1939) 496 Poor substantivity at low temperatures Dyes slightly duller than normal at high temperatures			VISCOSE: For data on strike, see *JSDC*, **55** (1939), 481 SILK: Substantivity, high FASTNESS SILK (ISO): Degumming 3–4 Light 6–7, 7, 7–8 Peroxide 4–5 Washing 4–5 WOOL: Substantivity, high; levelling, good FASTNESS WOOL (ISO): Milling 5 Light 7, 7–8, 7–8		SILK: Dye weakly acid adding sodium sulphoxylate-formaldehyde Develop by bichromate or ammonium persulphate WOOL: Substantivity, very good Weakly acid bath Develop by bichromate	**TEXTILE APPLICATION OTHER THAN COTTON**
See C.I. Pigment Blue 60						**NON-TEXTILE USAGE**

C.I. Vat Blue	6	6:1	Solubilised 6	7	Solubilised 7
C.I. Constitution Number or Chemical Class	69825		69826	70305	70306
Hue Artificial Light	Bright Blue Slightly Redder			Dull Greenish Blue Greener	
Reaction with conc. sulphuric acid (on cellulose)	Brownish Olive			Brown	
DYEING					
Method	1, (2)			1	
Vatting Temp. °C	⩾50			50–60 (Long liquor)	
Dyeing Temp. °C	⩾50			50–60	
Leuco Alkaline	Greenish Blue			Bluish Violet	
Acid	Reddish Blue			Bluish Red	
Substantivity	High		Poor	High	Fairly high
Levelling	Moderate			Moderate	
Remarks	Leuco compound sensitive to hard-water and over-reduction. Rinse after dyeing. Air oxidation gives duller, greener blues Avoid bichromate Soap thoroughly (+ soda)	Usage/properties: Similar to C.I. Vat Blue 6 Slightly different chemically	Neutral or weakly alkaline bath at 20–30°C Substantivity improved by adding NaCl Develop nitrite (hot or cold). Add thiourea to prevent over-development	Dead cotton covered well	Dye neutral or weakly alkaline Develop by nitrite Slightly sensitive to over-development Applicable by the one-bath method with development at 75°C
PRINTING					
Direct	×		✓	✓	✓
Coloured Resist	×		✓	✓	✓
White Resist	—		✓	—	—
Coloured Discharge	×		×	✓	×
White Discharge	×		×	×	×
Flash Ageing	✓		×	✓	×
Remarks	Poor fixation by the all-in method, but may be fixed by the flash-age method		Direct prints developed by chlorate, nitrite or bichromate	Avoid strongly alkaline pastes	Direct prints developed by bichromate

FASTNESS	AATCC	ISO	AATCC	ISO
Testing Method				
Cross Dyeing	5	5	4–5	4–5
Hot Pressing	5	5	5	4
Hypochlorite	3–4	3–4	4	4
Light	7, 7–8, 8	7, 7–8, 7–8	5–6, 6–7, 7	6, 6–7, 7
Mercerising	4	4	4	4
Peroxide Bleach	4–5	4–5	4	3–4
Soda Boil	4	4–5	4	3–4
Soda Boil (Hypochlorite)	4–5	3–4	—	Unsuitable
Washing Alteration	—	4–5	—	4–5
Staining	—	5	—	5
Remarks				

TEXTILE APPLICATION OTHER THAN COTTON	Viscose: For data on strike, see *JSDC*, **55** (1939) 406 Silk: Substantivity, high; levelling good Fastness silk (ISO): Degumming 4 Light 7–8, 8, 8 Peroxide 5 Washing 5		Silk: Neutral bath at 70°C adding Na_2SO_4 Substantivity moderate Develop by bichromate	Silk: Suitable Fastness silk (ISO): Degumming 4 Light 6, 6–7, 7 Peroxide 5 Washing 4–5	
NON-TEXTILE USAGE	See C.I. Pigment Blue 64			Rubber: Mass colouration	

8	Solubilised 8	Solubilised 9	10	C.I. Vat Blue
73800	73801	73071	69830	C.I. Constitution Number or Chemical Class
Blue→Navy Very slightly greener		Blue	Bright Blue Greener and duller	Hue Artificial Light
Bluish Green			Greenish brown	Reaction with conc. sulphuric acid (on cellulose)
4 70 40 Yellow Pale Yellow Low Good	Poor Dye neutral or weakly alkaline at 20–30°C Develop by nitrite (hot or cold)	High Dye neutral or weakly alkaline Development (nitrite process) is difficult Applicable by the one-bath process with development at 70°C	1, (2) ⩾50 ⩾50 Greenish Blue Blue High Good Temperatures higher than 50°C affect the hue and fastness to chlorine Bichromate should not be used Add soda ash to the soap bath	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
✓ ✓ — ✓ ✓ —	✓ ✓ ✓ × ✓ × Direct prints developed by chlorate, nitrite or bichromate	✓ ✓ ✓ × — ×	× × — × × —	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
ISO Good 4–5 4 5, 5–6, 6–7 4 4 3–4 3 — —		AATCC — 3 2–3 —, 3–4, — 4 3 — — — —	ISO 3–4 4 3 7, 7–8, 8 5 5 3–4 3 4–5 4–5	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
SILK: Suitable FASTNESS SILK (ISO): Degumming 3–4 Light 7, 7–8, 7–8 Peroxide 2–3 WOOL: Suitable FASTNESS WOOL (ISO): Milling 5 Light 8 Washing 5	SILK: Dye weakly acid adding sodium sulphoxylate-formaldehyde Substantivity, high Develop with bichromate WOOL: Dye weakly acid adding ammonium sulphate. Substantivity, high Develop with bichromate	SILK: Dye weakly acid Levelling, poor Develop bichromate WOOL: Dye weakly acid Substantivity, high; levelling, poor Develop with bichromate FASTNESS WOOL (AATCC): Light 7, 7, 7–8 Milling 4–5 Stoving 4 Washing 4–5	UNIONS: Fairly good solidity on cotton/viscose, dyed cold Viscose dyed heavier than cotton at 50°C	**TEXTILE APPLICATION OTHER THAN COTTON**
			PAPER: Stock colouration	**NON-TEXTILE USAGE**

C.I. Vat Blue	11	12	12:1	13	14	14:1
C.I. Constitution Number or Chemical Class	69815	69840		69845	69810	
Hue Artificial Light	Bright Blue Slightly Greener	Bright Blue Greener		Bright Greenish Blue Greener	Bright Blue Duller	
Reaction with conc. sulphuric acid (on cellulose)	Greenish Brown	Greenish Brown		Brownish Green	Greenish Brown	
DYEING						
Method	1	1, (2)		1	1, (2)	
Vatting Temp. °C	⩾50	50–60		60	50–60	
Dyeing Temp. °C	⩾50	50–60		50–60	50–60	
Leuco Alkaline	Blue	Blue		Dull Olive	Blue	
Acid	Blue	Bluish Violet		Bordeaux	Reddish Blue	
Substantivity	High	High		Moderate	High	
Levelling	Moderate	Good		Moderate	Good	
Remarks	Dyeing or vatting temperatures above 50°C affect the hue and fastness to chlorine. Hue restored by rinsing in dilute hydrosulphite soln	For method 2 increase NaOH by 15%. Do not add the salt at the commencement Rinse immediately after dyeing Avoid bichromate	Purified form of C.I. Vat Blue 12	Rinse with acidified water, immediately after dyeing	The leuco comp is sensitive to hard water, over-oxidn and high temp. Rinse after dyeing. Avoid bichromate Air oxidn gives duller and greener hue. Add soda ash to soap bath	USAGE/PROPERTIES: Similar to C.I. Vat Blue 14 Slightly different chemically
PRINTING						
Direct	√	√		√	√	
Coloured Resist	√	—		√	√	
White Resist	—	—		—	—	
Coloured Discharge	√	—		√	—	
White Discharge	×	×		×	×	
Flash Ageing	—	—		—	√	
Remarks		Soaping of direct prints above 80°C may cause staining of adjacent whites			Applicable in strongly alkaline pastes Oxidation by peroxide is preferable as bichromate causes dulling	
FASTNESS						
Testing Method	ISO	AATCC / ISO		ISO	AATCC / ISO	
Cross Dyeing	Good	— / —		Slightly Greener	5 / 4	
Hot Pressing	5	3 / 4–5		4–5	5 / 5	
Hypochlorite	3	1 / 2		1	2 / 2	
Light	7–8, 7–8, 8	—, 7–8, — / 7–8, 8, 8		7, 7, 7–8	7, 7–8, 8 / 7, 7–8, 7–8	
Mercerising	4	3 / 3–4		3–4	2–3 / 4	
Peroxide Bleach	4–5	4 / 3–4		4	4 / 4–5	
Soda Boil	4–5	— / 3		2	5 / 4–5	
Soda Boil (Hypochlorite)	Unsuitable	— / 3		Unsuitable	— / 2	
Washing Alteration	—	— / 4–5		3–4	— / 5	
Staining	—	— / 3–4		5	— / 5	
Remarks						
TEXTILE APPLICATION OTHER THAN COTTON		VISCOSE: Moderate substantivity at low temperature UNIONS: Viscose dyed heavier than cotton in cotton/viscose brocades WOOL: Suitable		VISCOSE: For data on strike, see *JSDC*, **55** (1939) 496 SILK: Suitable FASTNESS SILK (ISO): Degumming 3–4 Light 7, 7–8, 7–8 Peroxide 5 Washing 5	SILK: Substantivity, moderate; levelling, good FASTNESS SILK (ISO): Degumming 3–4 Light 7–8, 8, 8 Peroxide 5 Washing 5	
NON-TEXTILE USAGE		PAPER: Stock colouration			See C.I. Pigment Blue 67	

15	16	17	18	18:1	C.I. Vat Blue
70010	71200	Anthraquinone	59815		C.I. Constitution Number or Chemical Class
Blue Slightly Greener	Navy Redder	Dull Reddish Blue Redder	Reddish Blue→Reddish Navy Much Redder		Hue Artificial Light
Greenish Brown	Bluish Red	Dull Violet	Reddish Violet		Reaction with conc. sulphuric acid (on cellulose)
1 60 60 Greenish Blue BluishViolet — — Rinse immediately after dyeing	1, (2) 60 60 Blue Bordeaux Moderate Good For method 2, increase NaOH 15% Soap thoroughly to develop the true hue	1, (2) 60 60 Violet Dull Yellowish Red High Moderate Take usual precautions to ensure level dyeings in pale hues Soap thoroughly to develop the true hue	1, (2) 60 60 Greenish Blue Reddish Violet High Moderate Take precautions to ensure level dyeing of pale hues Soap thoroughly to develop the true hue Dead cotton covered moderately well	USAGE/PROPERTIES: Similar to C.I. Vat Blue 18 Slightly different chemically	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
× × — × × —	✓ ✓ — ✓ × —	✓ ✓ — ✓ × ✓	✓ ✓ — ✓ × ✓ Oxidation with bichromate does not alter the hue		**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
ISO — 4–5 2 7, 7, 7–8 4–5 4–5 4 Unsuitable — —	ISO Fairly good 3–4 4–5 6–7, 7, 7–8 4–5 4 4 Suitable 5 3–4	ISO 3 Greener 4 6–7, 7, 7–8 Slightly Redder 2–3 3 3 4 4–5	AATCC ISO 4 5 4 4 4 4 5, 6, 7 5, 6, 6–7 4 5 4 5 4 3 — Suitable — 4–5 — 4–5		**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
	VISCOSE: Low substantivity at low temperatures SILK: Substantivity, moderate; levelling, good FASTNESS SILK (ISO): Degumming 3–4 Light 6–7, 7, 7 Peroxide 4–5 Washing 5	VISCOSE: Low substantivity at low temperatures Dyes redder than normal at high temperatures	VISCOSE: Low substantivity at low temperatures Dyes redder than normal at high temperatures SILK: Suitable		**TEXTILE APPLICATION OTHER THAN COTTON**
					NON-TEXTILE USAGE

C.I. Vat Blue	19	20	20:1	21
C.I. Constitution Number or Chemical Class	59805	59800		67920
Hue Artificial Light	Reddish Navy Redder	Dull Bluish Violet→Reddish Navy Much redder		Bright Blue→Bright Reddish Blue Slightly redder
Reaction with conc. sulphuric acid (on cellulose)	Violet	Reddish Violet		
DYEING				
Method	1	1, (2)		
Vatting Temp. °C	50–60	50–60		
Dyeing Temp. °C	50–60	50–60		
Leuco Alkaline	Bluish Violet	Dull Violet		
Acid	Reddish Brown	Dull Red		
Substantivity	High	High		
Levelling	Moderately good	Moderate		
Remarks	Soap thoroughly to develop the true hue Dead cotton covered moderately well	Soap thoroughly to develop the true hue For report on strike, levelling and migration, see *JSDC*, **66** (1950) 505	USAGE/PROPERTIES: Similar to C.I. Vat Blue 20 Slightly different chemically	
PRINTING				
Direct	√	√		√
Coloured Resist	√	√		√
White Resist	√	—		—
Coloured Discharge	√	√		√
White Discharge	×	×		√
Flash Ageing	—	—		—
Remarks		Extra sodium sulphoxylate-formaldehyde and urea improve printing yield Oxidation by peroxide is preferred as bichromate causes dulling		Prints are not sensitive to oxidation Dischargeable to white in pale hues
FASTNESS				
Testing Method	ISO	AATCC ISO		ISO
Cross Dyeing	Good	3–4 5		—
Hot Pressing	4–5	1 1		—
Hypochlorite	4–5	4–5 4		5
Light	6, 7, 7	5–6, 6–7, 7 5–6, 6–7, 7		6, 6–7, 7
Mercerising	3	4 4–5		—
Peroxide Bleach	4	4 4		—
Soda Boil	3	3–4 3–4		—
Soda Boil (Hypochlorite)	Suitable	3–4 4		—
Washing Alteration	4–5	— 4–5		4
Staining	4–5	— 5		—
Remarks		Sensitive to both heat and water spotting		
TEXTILE APPLICATION OTHER THAN COTTON	VISCOSE: Dyed distinctly redder than cotton SILK: Suitable FASTNESS SILK (ISO): Degumming 4 Light 5, 5–6, 6–7 Peroxide 5 Washing 5	VISCOSE: Low substantivity at low temperatures. For data on strike, rate of diffusion and time of half-dyeing, see *JSDC*, **55** (1939) 481 SILK: Suitable FASTNESS SILK (ISO): Degumming 4 Light 5, 6, 6–7 Peroxide 5 Washing 5		
NON-TEXTILE USAGE		See C.I. Pigment Blue 65		

22	23	24	25	26	C.I. Vat Blue
59820	Anthraquinone		70500	60015	C.I. Constitution Number or Chemical Class
Reddish Blue→Reddish Navy Redder	Navy and Reddish Navy Redder		Reddish Blue→Reddish Navy Redder	Greenish Blue Redder	Hue Artificial Light
	Dark Blue		Reddish Violet	Bluish Red	Reaction with conc. sulphuric acid (on cellulose)
1, (2) 50–60 50–60 Blue Violet High Good Method 2 is suitable for shading only Dead cotton covered moderately well	1 50–60 50–60 Bluish Green Bluish Red Moderate Very good Add Na_2SO_4 during dyeing Oxidise before rinsing	This C.I. Generic Name is discontinued	1, (2) 60 50–60 Greenish Blue Violet High Good Soap thoroughly to develop the true hue Dead cotton covered moderately well	1, (2) 50–60 50–60 Blue Violet High Good Soap thoroughly to develop the true hue	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
√ √ — √ × —	× × — × × —		√ √ — √ × —	√ √ — √ × —	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
ISO Fairly good 4–5 4–5 6–7, 6–7, 7 3–4 4–5 2–3 Unsuitable 4–5 5	ISO Slight change 4 4 3, 4, 5 3 4 2–3 2 — —		ISO Very good 4 4–5 6–7, 7, 7–8 4 4 3–4 Suitable 4 5	ISO Good 4 3–4 6, 6–7, 7 4 4–5 4–5 Suitable 4–5 5	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
SILK: Substantivity, high; levelling, good FASTNESS SILK (ISO): Degumming 3–4 Light 6–7, 6–7, 6–7 Peroxide 4–5 Washing 5	SILK: Substantivity, high; levelling, very good FASTNESS SILK (ISO): Degumming 3–4 Light 3, 4, 5 Peroxide 4 Washing 4–5		VISCOSE: Dyed much redder than cotton SILK: Suitable FASTNESS SILK (ISO): Degumming 3–4 Light 6–7, 7, 7 Peroxide 4 Washing 5	SILK: Substantivity, high; levelling, good FASTNESS SILK (ISO) Degumming 3–4 Light 5–6, 6, 6–7 Peroxide 4–5 Washing 4–5	**TEXTILE APPLICATION OTHER THAN COTTON**
					NON-TEXTILE USAGE

C.I. Vat Blue	27	28	29	30
C.I. Constitution Number or Chemical Class	Anthraquinone	70005	74140	67110
Hue Artificial Light	Blue Redder	Blue→Navy Greener and duller	Bright Blue Greener	Blue Slightly redder
Reaction with conc. sulphuric acid (on cellulose)		Brownish Black		
DYEING				
Method		2, (1, 3)	2, (1)	2, (1, 3)
Vatting Temp. °C		45–50	30–40 (Short liquor)	45–50
Dyeing Temp. °C		45–50	45	45–50
Leuco Alkaline		Blue	Olive	Violet
Acid		Violet	Bluish Olive	Reddish Brown
Substantivity		High	Low	High
Levelling		Moderate	Very good	Very good
Remarks		For method 2 dye for the first 15 mins. without salt Rinse immediately after dyeing otherwise greener and duller blues result Dead cotton covered	For method 2, do not add NaCl For method 1 the NaOH 72°Tw should not exceed 20 mls per litre	For method 1, add NaCl Dead cotton covered moderately well
PRINTING				
Direct	√	√	√	×
Coloured Resist	√	√	√	×
White Resist	—	—	—	—
Coloured Discharge	√	√	√	×
White Discharge	√	×	×	√
Flash Ageing	—	—	—	—
Remarks				
FASTNESS				
Testing Method	ISO	ISO	ISO	ISO
Cross Dyeing	—	Fairly good	—	Good
Hot Pressing	5	4–5	5	5
Hypochlorite	5	2	1	5
Light	6–7, 7, 7	7–8, 8, 8	7, 7–8, 8	7, 7–8, 8
Mercerising	5	3	4	5
Peroxide Bleach	—	2–3	4	5
Soda Boil	—	4	3–4	4–5
Soda Boil (Hypochlorite)	—	Unsuitable	Unsuitable	Suitable
Washing Alteration	4–5	4–5	—	4–5
Staining	5	5	—	5
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON		SILK: Substantivity, high; levelling, good FASTNESS SILK (ISO): Degumming 4 Light 7, 7–8, 7–8 Peroxide 4 Washing 5	SILK: Suitable FASTNESS SILK (ISO): Degumming 4 Light 6, 6–7, 7 Peroxide 1–2 Washing 4–5	SILK: Substantivity, high; levelling, good FASTNESS SILK (ISO): Degumming 5 Light 6, 6–7, 6–7 Peroxide 5 Washing 5
NON-TEXTILE USAGE			PAPER: Stock colouration	

31	32	33	34	C.I. Vat Blue
67105	67910	67915	73055	C.I. Constitution Number or Chemical Class
Dull Blue Redder and duller	Greenish Blue Greener	Bright Greenish Blue Much Greener	Reddish Blue→Reddish Navy Redder	Hue Artificial Light
Yellow	Yellowish Green→Brown	Yellowish Green→ Brownish Yellow	Bluish Green	Reaction with conc. sulphuric acid (on cellulose)
2, (1, 3) 45–50 45–50 Dull Violet Reddish Brown High Very good Dead cotton covered moderately well	3 40 20–25 Dull Violet Yellow High Good Reduce NaOH by 33% as leuco compound is sensitive to excess Air oxidation gives duller hues Dead cotton covered moderately well	3, (2) 20–25 20–25 Reddish Brown Olive→Yellowish Brown High Very good For method 3, reduce NaOH by 20% Protect unoxidised dyeings from direct sunlight	4 50–60 25–30 Yellow Colourless Moderate Good After dyeing thoroughly air-oxidise, acidify, rinse and soap Also applicable by the zinc-lime and ferrous sulphate processes	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
✓ ✓ ✓ ✓ ✓ —	✓ ✓ — ✓ — —	✓ ✓ — ✓ ✓ — Dischargeable to white in pale and medium hues only	✓ ✓ ✓ ✓ ✓ —	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
ISO Good 5 4–5 7, 7–8, 8 4–5 4–5 4 Suitable 4–5 5	ISO Good 4–5 3–4 6–7, 7, 7–8 4 3 2–3 Unsuitable — —	ISO Moderate 4–5 3–4 7, 7–8, 8 3 3 3 3 4 5	ISO 3–4 4 2 2–3, 3, 3–4 3 3 2 2 — —	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
	SILK: Suitable WOOL: Vat in stock vat at 30°C and dye in ammonia/hydrosulphite vat at 60–65°C FASTNESS WOOL (ISO): Light 6–7, 7, 7–8 Milling 5 Stoving 5 Washing 5	UNIONS: Good solidity on cotton/viscose	SILK: Substantivity, moderately high FASTNESS SILK (ISO): Degumming 3 Light 4–5, 5, 5–6 Peroxide 4; Washing 4–5 WOOL: From an ammonia/hydrosulphite vat FASTNESS WOOL (ISO): Milling 5 Light 7, 7–8, 7–8 Stoving 5; Washing 5	**TEXTILE APPLICATION OTHER THAN COTTON**
				NON-TEXTILE USAGE

C.I. Vat Blue	35	36	37	38
C.I. Constitution Number or Chemical Class	73060	73675	73050	—
Hue Artificial Light	Dull Blue→Navy Duller	Blue Redder	Blue Redder	Dull Blue Redder
Reaction with conc. sulphuric acid (on cellulose)	Bluish Green	Bluish Green	Bluish Green	
DYEING				
Method	4	4	4	2, (1, 3)
Vatting Temp. °C	70–80	70	50–55	50
Dyeing Temp. °C	40–50	50	50	45
Leuco Alkaline	Yellow	Yellow	Yellowish Brown	Reddish Violet
Acid	Pale Yellow	Pale Yellow	Colourless	Yellowish Brown
Substantivity	High	Poor	Moderate	High
Levelling	Good	Good	Good	Very good
Remarks			Soap thoroughly to develop the true hue Dead cotton covered well	
PRINTING				
Direct	✓	✓	✓	×
Coloured Resist	✓	✓	✓	×
White Resist	✓	—	✓	—
Coloured Discharge	✓	✓	✓	×
White Discharge	✓	—	✓	✓
Flash Ageing	—	—	—	—
Remarks				Used as a ground for white discharge styles
FASTNESS				
Testing Method	AATCC ISO	ISO	ISO	ISO
Cross Dyeing	5 —	Good	Good	4
Hot Pressing	5 3–4	4	5	4
Hypochlorite	1 2–3	4	2	4
Light	4, 4–5, 5 4, 4–5, 5	5, 5–6, 5–6	3–4, 4, 4–5	7, 7–8, 8
Mercerising	3 1	5	2–3	3
Peroxide Bleach	3–4 3–4	4	3	4–5
Soda Boil	— 3	4	2	3
Soda Boil (Hypochlorite)	— Unsuitable	3–4	Unsuitable	—
Washing Alteration	— —	—	—	4–5
Staining	— —	—	—	5
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON	SILK: Suitable WOOL: Substantivity, high; levelling, good FASTNESS WOOL (ISO): Milling 5 Light 7, 7–8, 7–8 Stoving 3 Washing 5	SILK: Suitable FASTNESS SILK (ISO): Degumming 3–4 Light 7 WOOL: Suitable FASTNESS WOOL (ISO): Milling 3 Light 7–8 Washing 5	SILK: Suitable FASTNESS SILK (ISO): Degumming 3–4 Light 6, 6–7, 7 Peroxide 4–5 Washing 5 WOOL: Suitable FASTNESS WOOL (ISO): Milling 5 Light 7, 7–8, 7–8 Stoving 5 Washing 5	SILK: Suitable FASTNESS SILK (ISO): Degumming 4–5 Light ($\frac{1}{3}$N) 6–7 Peroxide 5 Washing 5
NON-TEXTILE USAGE				

39	40	41	Solubilised 41	C.I. Vat Blue
Anthraquinone	73805	73040	73041	C.I. Constitution Number or Chemical Class
Blue Slightly Redder	Reddish Blue→Reddish Navy Redder	Reddish Blue Redder		Hue Artificial Light
Brown	Bluish Green	Bluish Green		Reaction with conc. sulphuric acid (on cellulose)
2 45–50 45–50 Reddish Violet Orange High Good	4 70 50 Yellow Pale Yellow Low Good	4 60 50–60 Yellow Colourless Moderate Good Dead cotton covered well		**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
× × — × ✓ —	✓ ✓ ✓ ✓ — —	✓ ✓ ✓ ✓ ✓ — In direct printing K_2CO_3 is preferable to Na_2CO_3 or NaOH Oxidation with bichromate does not alter the hue		**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
AATCC — 4 5 —, 6–7, — 5 5 — 4–5 4–5 5	ISO — 4 4 5, 5, 5–6 4 4 4 3–4 4–5 5	ISO 5 5 1 4, 4–5, 5 3–4 3 2 1 3–4 4		**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
	SILK: Suitable WOOL: Suitable	SILK: Substantivity, high; levelling, good FASTNESS SILK (ISO): Degumming 2–3 Light 6, 6, 6–7 Peroxide 3–4; Washing 4–5 WOOL: Substantivity, high; levelling good FASTNESS WOOL (ISO): Milling 5 Light 7, 7–8, 7–8 Stoving 5; Washing 5		**TEXTILE APPLICATION OTHER THAN COTTON**
			NON-TEXTILE USAGE

C.I. Vat Blue	42	Reduced 42	43	Reduced 43
C.I. Constitution Number or Chemical Class	53640		53630	
Hue Artificial Light	Blue→Reddish Navy Duller		Reddish Blue→Reddish Navy Slightly Greener	
Reaction with conc. sulphuric acid (on cellulose)	Blue		Blue	
DYEING				
Method	1, Special		1, Special	
Vatting Temp. °C	60–70 (Method 1)		60 (Method 1)	
Dyeing Temp. °C	60–70 (Method 1)		60 (Method 1)	
Leuco Alkaline	Yellow		Brownish Yellow	
Acid	Dull Greenish Yellow		Dull Greenish Yellow	
Substantivity	High		High	
Levelling	Very good		Very good	
Remarks	Special method using NaOH, Na_2Sn and $Na_2S_2O_4$; stock vat temperature 70°C; dyeing temperature 65°C Dead cotton covered		Special method using NaOH, Na_2Sn and $Na_2S_2O_4$; stock vat temperature 70–80°C; dyeing temperature 60°C Also from a sodium sulphide bath as for sulphur dyes	
PRINTING				
Direct	×		×	
Coloured Resist	×		×	
White Resist	—		—	
Coloured Discharge	×		×	
White Discharge	—		×	
Flash Ageing	—		—	
Remarks				
FASTNESS	AATCC / ISO		AATCC / ISO	
Testing Method	— / —		4 / 4–5	
Cross Dyeing	5 / 4		4 / 3	
Hot Pressing	3 / 3		3 / 3	
Hypochlorite	4–5, 5, — / 4, 5, 6		4, 4–5, — / 4, 5, 6	
Light	4 / 3		— / 3	
Mercerising	4 / 3		3 / 3	
Peroxide Bleach	— / 2		— / 2	
Soda Boil	— / Unsuitable		— / Unsuitable	
Soda Boil (Hypochlorite)	— / —		— / 4	
Washing Alteration	— / —		— / 4	
Staining				
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON	VISCOSE: For data on strike, rate of diffusion and time of half-dyeing, see *JSDC*, **55** (1939), 481		VISCOSE: For data on strike, rate of diffusion and time of half-dyeing, see *JSDC*, **55** (1939), 481 SILK: Suitable FASTNESS SILK (ISO): Degumming 5 Light 4, 4–5, 5 Peroxide 5 Washing 4–5	
NON-TEXTILE USAGE				

44	45	46	47	48	C.I. Vat Blue
Sulphur Reddish Blue Slightly Greener	Sulphur Reddish Navy Slightly Greener		53630 Reddish Navy	73075 Blue Slightly Greener	C.I. Constitution Number or Chemical Class Hue Artificial Light
Blue	Blue		Blue	Bluish Green	Reaction with conc. sulphuric acid (on cellulose)
4, Special 70–80 (Method 4) 60 (Method 4) Pale Reddish Yellow Colourless Moderate Very good Special method using NaOH, Na_2Sn and $Na_2S_2O_4$ Also from sodium sulphide bath as for sulphur dyes Rinse immediately after dyeing	4, Special 70–80 (Method 4) 60 (Method 4) Pale Reddish Yellow Colourless Moderate Very good Special method uses NaOH, Na_2Sn and $Na_2S_2O_4$ May also be dyed from a sodium sulphide bath as for sulphur dyes Rinse immediately after dyeing	This C.I. Generic Name is discontinued	1, Special 60–70 (Method 1) 60–70 (Method 1) Golden Yellow Olive Moderate Very good Special method uses NaOH, Na_2Sn and $Na_2S_2O_4$ Stock vat temperature 60–70°C. Dyeing temperature 60–70°C Dead cotton covered well	4 50–60 50–60 Yellow Pale Yellow High Good Soap thoroughly to develop the true hue Dead cotton covered	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
× × — × × —	× × — × × —		× × — × × —	√ √ — √ √ —	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
ISO 4–5 3 2–3 4, 5, 6 5 3 3–4 3 4 4	ISO 4–5 3 2–3 4, 5, 6 5 3 3–4 3 4 4		ISO — 5 3 —, —, 6 3–4 — 4–5 Unsuitable — —	ISO Good 5 3 3–4, 4, 4–5 2 2–3 2 Unsuitable — —	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
SILK: Suitable	SILK: Suitable			SILK: Suitable FASTNESS SILK (ISO): Degumming 3 Light 6, 6, 6–7 Peroxide 4 Washing 4–5 WOOL: Suitable FASTNESS WOOL (ISO): Milling 5 Light 7, 7–8, 7–8 Stoving 5 Washing 5	**TEXTILE APPLICATION OTHER THAN COTTON**
					NON-TEXTILE USAGE

C.I. Vat Blue	49	50	51	52
C.I. Constitution Number or Chemical Class	Sulphur	Sulphur	59856	Anthraquinone
Hue Artificial Light	Reddish Navy Greener	Reddish Navy Slightly Greener	Reddish Navy	Bright Reddish Blue Much Duller and Redder
Reaction with conc. sulphuric acid (on cellulose)	Blue	Blue		
DYEING				
Method	4, Special	4, Special	1	2, (1, 3)
Vatting Temp. °C	70–80	70–80	50–60	50
Dyeing Temp. °C	60	60	—	50
Leuco Alkaline	Pale Reddish Yellow	Pale Reddish Yellow	Violet	Dull Bluish Red
Acid	Colourless	Colourless		—
Substantivity	Moderate	Moderate		High
Levelling	Very good	Very good		Good
Remarks	Special method uses NaOH, Na_2S_n and $Na_2S_2O_4$ Also from a sodium sulphide bath as for sulphur dyes Rinse immediately after dyeing	Special method uses NaOH, Na_2S_n and $Na_2S_2O_4$ Also from a sodium sulphide bath as for sulphur dyes Rinse immediately after dyeing		Dyeing temperatures up to 90°C can be emplyed without deterioration in properties
PRINTING				
Direct	×	×		×
Coloured Resist	×	×		×
White Resist	—	—		—
Coloured Discharge	×	×		×
White Discharge	×	×		—
Flash Ageing	—	—		✓
Remarks				
FASTNESS				
Testing Method	ISO	ISO	ISO	ISO
Cross Dyeing	4–5	4–5	—	5
Hot Pressing	3	3	—	4
Hypochlorite	2–3	2–3	4	4
Light	4, 4–5, 5–6	4, 4–5, 5–6	—, 6–7,	6, 6–7, 6–7
Mercerising	5	5	5	—
Peroxide Bleach	3	3	4	5
Soda Boil	3–4	3–4	3	5
Soda Boil (Hypochlorite)	3	3	—	4
Washing Alteration	4	4–5	3–4	4–5
Staining	4	4	—	5
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON	SILK: Suitable FASTNESS SILK (ISO): Degumming 4–5 Light 4, 4–5, 5 Peroxide 5 Washing 4–5	SILK: Suitable		SILK: Suitable FASTNESS SILK (ISO): Degumming 4–5 Light 6 Washing 5
NON-TEXTILE USAGE				

53	54,55	56	57	C.I. Vat Blue
71205 Greenish Blue→Bluish Green		Carbazol Reddish Blue	Phthalocyanine Bright Blue Greener	C.I. Constitution Number or Chemical Class Hue Artificial Light
Reddish Violet				Reaction with conc. sulphuric acid (on cellulose)
1 50–60 50–60 Blue Reddish Violet Very high Moderate Dyeings require thorough soaping Good stability to high temperature dyeing	These C.I. Generic Names are discontinued	1+, Special 70 70 Reddish Yellow — — — Special method uses sodium sulphide vat Stock vat temperature 80–90°C Dyeing temperature 80–90°C	2, (1) 30–40 (Short liquor) 45 Olive Bluish Olive Low Good	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
✓ ✓ — ✓ — —				**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
AATCC — 3–4 4 4–5, 6, 7–8 4 4–5 — — 4 5		ISO — — — 5, 5–6, 6 — — — — 4–5 —	ISO — 5 1 7, 7–8, 8 4 4 3–4 Unsuitable — —	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
				TEXTILE APPLICATION OTHER THAN COTTON
				NON-TEXTILE USAGE

C.I. Vat Blue	58	59,60	61	62	63
C.I. Constitution Number or Chemical Class	Thiazine (benzoquinone deriv.)		Anthraquinone	Anthraquinone	Anthraquinone
Hue Artificial Light	Bright Blue Slightly duller		Reddish Navy Redder	Dull Blue	Dull Blue
Reaction with conc. sulphuric acid (on cellulose)	Greenish Blue		Maroon		Yellowish Green
DYEING		These C.I. Generic Names are discontinued			
Method			2, 3	2	2
Vatting Temp. °C			50–60	45–60	50
Dyeing Temp. °C			50–60	45–60	45–50
Leuco Alkaline			Bright Blue	Blue	Bluish Violet
Acid			Red	Violet	Grey
Substantivity			High	High	High
Levelling			Good	Good	Very good
Remarks					Can be vatted in long or short liquors Unsuitable for covering dead cotton
PRINTING					
Direct	✓		✓		✓
Coloured Resist	✓		✓		✓
White Resist	—		—		—
Coloured Discharge	✓		✓		✓
White Discharge	×		—		×
Flash Ageing	—		—		—
Remarks					
FASTNESS					
Testing Method	ISO		AATCC	ISO	ISO
Cross Dyeing	—		—	—	5
Hot Pressing	—		3–4	4–5	3–4
Hypochlorite	4		3–4	4–5	5
Light	4–5, 5–6, 6–7		—, 5–6, —	6, 6–7, 7	6–7, 7, 7–8
Mercerising	—		—	3–4	3
Peroxide Bleach	—		2–3	4–5	5
Soda Boil	—		—	4	5
Soda Boil (Hypochlorite)	—		—	—	Suitable
Washing Alteration	3–4		4	4–5	—
Staining	4		—	5	—
Remarks					
TEXTILE APPLICATION OTHER THAN COTTON				SILK: Suitable FASTNESS SILK (ECE): Light 5–6, 7, 7 Peroxide 4–5	
NON-TEXTILE USAGE					

64	65	66	67	68	C.I. Vat Blue
Anthraquinone Blue	Anthraquinone Navy	Anthraquinone Blue	Anthraquinone Blue		C.I. Constitution Number or Chemical Class Hue Artificial Light
Yellowish Green	Yellowish Green				Reaction with conc. sulphuric acid (on cellulose)
2 50 45–50 Bordeaux Dark Brown High Very good May be vatted in long or short liquor Covering of dead cotton, poor	2 50–60 35–50 Navy Olive High Very good May be vatted in long or short liquors Unsuitable for covering dead cotton	2, (3) 50 45–50 Blue Violet High Very good Maximum dyeing temperature 90°C Not susceptible to over-reduction or over-oxidation Poor coverage of dead cotton	2, (1) 50 45–60 Blue Violet Moderate Good Poor coverage of dead cotton	This C.I. Generic Name is discontinued	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
✓ ✓ — ✓ × —	✓ ✓ — ✓ — —	— — — — ✓ —			**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
ISO — 4 5 6–7, 7, 7–8 5 4–5 4–5 Suitable — —	ISO 5 4–5 4–5 6–7, 7–8, 7–8 3–4 4–5 4–5 Suitable — —	ISO — 4–5 — 7, 7–8, 7–8 4–5 4–5 4–5 Suitable 4–5 5	ISO — 4 4–5 6, 6–7, 7 4–5 4–5 4–5 Unsuitable 4–5 5		**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
SILK: Suitable, method 2 FASTNESS SILK (ECE): Degumming 5 Light 4–5, 5–6, 6–7 Peroxide 5 Washing 5			SILK: Suitable FASTNESS SILK (ECE): Light 4, 5–6, 7, 7 Washing 4–5		**TEXTILE APPLICATION OTHER THAN COTTON**
					NON-TEXTILE USAGE

C.I. Vat Blue	69	70	71	72	Solubilised 73
C.I. Constitution Number or Chemical Class		Anthraquinone		Anthraquinone	Anthraquinone
Hue Artificial Light	Greenish Blue	Greenish Blue Greener		Navy	Greenish Blue Redder
Reaction with conc. sulphuric acid (on cellulose)		Scarlet			
DYEING			This C.I. Generic Name is discontinued		
Method		2, 3		1	
Vatting Temp. °C		50		50–60	
Dyeing Temp. °C		50		55–60	
Leuco Alkaline		Ruby		Bluish Violet	
Acid		Light Brown		—	
Substantivity		High		Moderate	Moderate
Levelling		Good		Moderate	
Remarks		Good coverage of dead cotton			Solubility more than 50 g/l. Applicable by pad or jig dyeing Develop by chlorate/steam or nitrite
PRINTING					
Direct	✓	✓		✓	✓
Coloured Resist	✓	×		✓	✓
White Resist	—	×		—	✓
Coloured Discharge	✓	✓		✓	×
White Discharge	—	×		×	×
Flash Ageing	—	—		—	×
Remarks					Direct prints developed by chlorate or nitrite
FASTNESS					
Testing Method	ISO	ISO		JIS	ISO
Cross Dyeing	—	4–5		—	5
Hot Pressing	5	5		3–4	4–5
Hypochlorite	4	4–5		2–3	4
Light	6–7, 7, 7	6–7, 7, 7–8		7–8, 8, 8	6, 6–7, 7
Mercerising	—	4		3–4	5
Peroxide Bleach	—	5		4	4–5
Soda Boil	—	4		4	4–5
Soda Boil (Hypochlorite)	—	5		—	—
Washing Alteration	4	4–5		4–5	4–5
Staining	4–5	5		5	5
Remarks					
TEXTILE APPLICATION OTHER THAN COTTON					
NON-TEXTILE USAGE					

C.I. Vat Green	1	Solubilised 1	2	Solubilised 2
C.I. Constitution Number or Chemical Class	59825	59826	59830	59831
Hue Artificial Light	Bright Green Yellower		Bright Green Yellower	
Reaction with conc. sulphuric acid (on cellulose)	Bluish Red		Bluish Red	
DYEING				
Method	1, (2, 3)		1, (2, 3)	
Vatting Temp. °C	50–60		50–60	
Dyeing Temp. °C	45–60		50–60	
Leuco Alkaline	Blue		Blue	
Acid	Bright Red		Bluish Red	
Substantivity	High	High	High	High
Levelling	Very good		Moderate	
Remarks	For report on strike, levelling and migration, see *JSDC*, **66** (1950), 505 Dead cotton covered moderately well	Dye weakly alkaline at 50–55°C, adding NaCl Develop by nitrite (hot or cold)	Dead cotton covered moderately well	Dye weakly alkaline at 50–65°C, adding NaCl Develop by nitrite (hot or cold)
PRINTING				
Direct	✓	✓	✓	✓
Coloured Resist	✓	✓	✓	✓
White Resist	—	✓	—	✓
Coloured Discharge	✓	×	✓	×
White Discharge	✓	✓	×	×
Flash Ageing	✓	×	✓	×
Remarks	Avoid strongly alkaline print pastes Dischargeable in pale and medium depths	Direct prints developed by chlorate, nitrite or bichromate Dischargeable in pale and medium depths	Oxidation by peroxide is preferred as bichromate causes dulling	Direct prints developed by nitrite, chlorate or bichromate
FASTNESS				
Testing Method	AATCC	ISO	AATCC	ISO
Cross Dyeing	4	5	4–5	4
Hot Pressing	4–5	1	5	3
Hypochlorite	4–5	4	4	3
Light	5–6, 6–7, 7–8	6–7, 7, 7–8	6, 6–7, 6–7	5–6, 6–7, 7
Mercerising	4	4–5	4–5	4–5
Peroxide Bleach	4–5	4–5	4–5	4–5
Soda Boil	5	4–5	3–4	4–5
Soda Boil (Hypochlorite)	—	5	2–3	3–4
Washing Alteration	—	4–5	—	5
Staining	—	4–5	—	4
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON	VISCOSE: See *JSDC*, **55** (1939), 481 SILK: Substantivity high FASTNESS SILK (ISO): Degumming 3–4 Light 7, 7–8, 7–8 Peroxide 5; Washing 5 WOOL: Suitable FASTNESS WOOL (AATCC): Light 7 Milling (III) 4 Peroxide 5 Stoving 4	SILK: Dye neutral adding Na_2SO_4. Develop by bichromate or persulphate WOOL: Dye neutral adding sodium sulphoxylate-formaldehyde. High substantivity. Develop with nitrite or bichromate	VISCOSE: Dyes yellower than normal at low temp. and bluer at high temp. SILK: High substantivity FASTNESS SILK (ISO): Degumming 3–4 Light 6–7, 7, 7–8 Peroxide 5 Washing 5 UNIONS: Good solidity on cotton/viscose dyed cold	SILK: Dye neutral adding Na_2SO_4. Substantivity high. Develop by bichromate or persulphate WOOL: Dye neutral adding sodium sulphoxylate-formaldehyde. Substantivity high. Develop by nitrite or bichromate
NON-TEXTILE USAGE	PAPER: Stock colouration SOAP		PAPER: Stock colouration	

C.I. Vat Green	3	3:1	Solubilised 3	4	Solubilised 4
C.I. Constitution Number or Chemical Class	69500		69501	59835	59836
Hue Artificial Light	Dull Green Yellower and brighter			Bright Bluish Green Yellower	
Reaction with conc. sulphuric acid (on cellulose)	Green			Bluish Red	
DYEING					
Method	1, (2, 3)			1, (2, 3)	
Vatting Temp. °C	50–60			45–55	
Dyeing Temp. °C	50–60			45–55	
Leuco Alkaline	Dark Blue			Blue	
Acid	Dull Brown			Bluish Red	
Substantivity	High		High	High	Moderately high
Levelling	Moderate			Very good	
Remarks	For method 2 increase NaOH by 15%. Method 3 suitable for shading only Soap thoroughly to develop the true hue	USAGE/PROPERTIES: Similar to C.I. Vat Green 3 Slightly different chemically	Dye weakly alkaline at 60–70°C adding NaCl to exhaust. Develop by nitrite (hot or cold) Add thiourea as dye is sensitive to over-development		Dye neutral or weakly alkaline Develop by nitrite
PRINTING					
Direct	✓		✓	✓	✓
Coloured Resist	✓		✓	✓	✓
White Resist	—		✓	—	✓
Coloured Discharge	✓		×	✓	×
White Discharge	×		×	×	×
Flash Ageing	✓		×	—	×
Remarks	Avoid strongly alkaline printing pastes Oxidation with bichromate does not alter the hue		Direct prints developed by nitrite, chlorate or bichromate		
FASTNESS					
Testing Method	AATCC		ISO	ISO	
Cross Dyeing	4–5		5	Fairly good	
Hot Pressing	5		4–5	4	
Hypochlorite	4–5		4–5	4	
Light	7–8, 8, 8		7–8, 8, 8	6–7, 7, 7	
Mercerising	4–5		4–5	4	
Peroxide Bleach	4–5		4–5	4	
Soda Boil	4		4	4	
Soda Boil (Hypochlorite)	4		5	Suitable	
Washing Alteration	—		4	4–5	
Staining	—		4–5	5	
Remarks					
TEXTILE APPLICATION OTHER THAN COTTON	VISCOSE: For data on strike, see *JSDC*, **55** (1939), 496 SILK: Substantivity moderate FASTNESS SILK (ISO): Degumming 4 Light 6–7, 7, 7 Peroxide 5; Washing 5 WOOL: Suitable FASTNESS WOOL (AATCC): Light 7 Milling (III) 3–4 Washing (III) 4		SILK: High substantivity Normal application and development by bichromate or ammonium persulphate WOOL: Dye neutral adding sodium sulphoxylate-formaldehyde and sodium sulphate at 90–95°C Develop by nitrite or bichromate	VISCOSE: Dyes yellower than normal at low and duller at high temp SILK: Suitable FASTNESS SILK (ISO): Degumming 5 Light 6, 7, 7 Peroxide 4–5 Washing 5 UNIONS: Viscose dyed bluer than cotton on cotton/viscose	SILK: Dye neutral or weakly alkaline at 80–90°C adding NaCl Substantivity high Develop by ammonium persulphate
NON-TEXTILE USAGE					

5	6	7	7:1	8	C.I. Vat Green
69520	69855	58825		71050	C.I. Constitution Number or Chemical Class
Olive Yellower	Dull Green Yellower	Olive Slightly Redder		Olive Brighter and yellower	Hue Artificial Light
Green	Bluish Green	Brownish Green		Dull Blue	Reaction with conc. sulphuric acid (on cellulose)
1+, 1, (2) 50–60 50–60 Dark Blue Dull Reddish Brown High Good When dyeing in a short liquor use method 1+ For method 2, increase NaOH by 15% Dead cotton covered moderately well	1, (2, 3) 50 50 Grey Dull Reddish Green High Very good Avoid strong oxidising agents Dead cotton covered moderately well	1, (2) 50–60 50–60 Bluish Olive Brown High Good Dead cotton covered failry well	USAGE/PROPERTIES: Similar to C.I. Vat Green 7 Slightly different chemically	1, (2) 60 60 Brownish Red Olive High Good For consistent results dyeing conditions must be strictly adhered to Oxidise in acid bichromate Dead cotton covered	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
✓ ✓ — ✓ × —	× × — × × —	× × — × — —		× × — × × — Poor fixation in direct printing by the all-in method	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
ISO Good 5 4–5 7–8, 7–8, 8 4 4 4 Suitable 4–5 5	ISO 3 3–4 2 6–7, 7, 7–8 5 4–5 3–4 2 3 4–5	AATCC / ISO — / 5 5 / 5 2 / 1 —, 6–7, — / 6, 6–7, 7 — / 4–5 3 / 2 — / 4–5 — / 1 — / 4–5 — / 5		AATCC / ISO 4–5 / 4–5 5 / 4 4–5 / 5 6–7, 7, 7–8 / 6–7, 7, 7–8 4–5 / 4–5 4 / 4 5 / 4–5 4–5 / 4 — / 4–5 — / 5	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
VISCOSE: For data on strike, see *JSDC*, **55** (1939), 496 UNIONS: Good solidity on cotton/viscose SILK: High substantivity, good levelling FASTNESS SILK (ISO): Degumming 4 Light 6, 6–7, 7 Peroxide 5 Washing 5	VISCOSE: For data on strike, see *JSDC*, **55** (1939), 481 SILK: Suitable UNIONS: Good solidity on cotton/viscose when dyed cold Viscose dyed heavier than cotton at 50°C			VISCOSE: Poor build up For data on strike, rate of diffusion and time of half-dyeing, see *JSDC*, **55** (1939), 481 SILK: High substantivity, moderate levelling FASTNESS SILK (ISO): Degumming 4–5 Light 7, 7–8, 8 Peroxide 5 Washing 5	**TEXTILE APPLICATION OTHER THAN COTTON**
		Paper: Coating			**NON-TEXTILE USAGE**

C.I. Vat Green	9	10	11
C.I. Constitution Number or Chemical Class	59850	Anthraquinone	69850
Hue Artificial Light	(Direct) Dull Green, (Oxidised) Bluish Black (Direct) Sl. Yellower, (Oxidised) Sl. Redder	Dull Olive Brighter and Greener	Bluish Green Yellower
Reaction with conc. sulphuric acid (on cellulose)	(Direct) Violet (Oxidised) Black, bleeds violet	Yellowish Green	Bluish Green
DYEING			
Method	1	1, (2)	1, (2, 3)
Vatting Temp. °C	60	45 (Short liquor)	60
Dyeing Temp. °C	60–80	60	50–60
Leuco Alkaline	Violet	Dull Violet	Dull Greenish Blue
Acid	Dull Red	Brown	Dull Blue
Substantivity	High	—	High
Levelling	Good	—	Moderately good
Remarks	Dyeings turn black when treated with chlorine or other oxidising agents When dyeing deep hues for oxidation to blacks use increased NaOH	Substantivity increased by adding NaCl At higher temperatures, duller hues result	Owing to limited solubility avoid stock vats or short liquors Avoid strong oxidising agents Dead cotton covered moderately well
PRINTING			
Direct	×		✓
Coloured Resist	×		×
White Resist	—		—
Coloured Discharge	×		×
White Discharge	×		×
Flash Ageing	—		—
Remarks			Only moderate fixation in direct printing by the all-in method
FASTNESS	Direct / Oxidised		
Testing Method	AATCC / ISO / AATCC / ISO	ISO	ISO
Cross Dyeing	4 / 1 / 5 / 5	—	Greyer
Hot Pressing	5 / 4 / 5 / 5	5	5
Hypochlorite	— / 1 / 4 / 4–5	5	1
Light	—, —, 7 / 5, 6, 6 / 6–7, 7, 8 / —, —, 7–8	5–6, 6, 7	7, 7–8, 8
Mercerising	3 / 5 / 3 / 4–5	5	4–5
Peroxide Bleach	4 / 4 / 4 / 4–5	5	4–5
Soda Boil	5 / 3–4 / 5 / 3	3–4	4–5
Soda Boil (Hypochlorite)	— / 1 / — / 3	—	Unsuitable
Washing Alteration	— / 5 / — / 5	—	4
Staining	— / 4–5 / — / 3–4	—	4
Remarks			
TEXTILE APPLICATION OTHER THAN COTTON	VISCOSE: For data on strike, see *JSDC*, **55** (1939) 496 SILK: Suitable FASTNESS SILK (ISO): Oxidised: Degumming 3–4; Light 7–8 Peroxide 5; Washing 5 WOOL: Suitable when oxidised FASTNESS WOOL (AATCC): Oxidised: Milling (III) 4–5 Light 7–8		VISCOSE: High substantivity dyed cold by methods 2 and 3. Dyes yellower and duller at high temperature SILK: Suitable FASTNESS SILK (ISO): Degumming 4 Light 7, 7–8, 8 Peroxide 5 Washing 5
NON-TEXTILE USAGE			PAPER: Stock colouration

12	13	14	15	C.I. Vat Green
70700	—	58830	Anthraquinone	C.I. Constitution Number or Chemical Class
Greenish Yellow Duller and yellower	Olive Yellower	Olive Greener	Olive Yellower	Hue Artificial Light
Reddish Yellow		Brownish Green	Greenish Black	Reaction with conc. sulphuric acid (on cellulose)
1, (2) 60 50–60 Brown Brownish Olive Moderate Good For method 2, increase NaOH by 15%	1, (1+, 2) 50 50–60 Olive Yellowish Olive High Good Dead cotton covered well	1 60 60 Bluish Green Olive Moderate Good	2 60 50 Greenish Black — High Good	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
✓ ✓ — ✓ ✓ — Dischargeable in pale hues only		✓ ✓ — ✓ — — When required for printing use the special brand		**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
ISO Good 5 4–5 6, 6–7, 7 4–5 4–5 4 Suitable 5 5	ISO 5 4–5 4 7–8, 7–8, 8 4–5 4 4 Suitable 4–5 4–5	ISO — 4–5 1 5, 5, 6 3–4 2 5 Unsuitable 5 5	AATCC — 4 4 —, 8, — — 3 — — — —	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
SILK: Suitable but fastness to light lower than on cotton FASTNESS SILK (ISO): Degumming 4 Light 4, 5, 5 Peroxide 5 Washing 5	SILK: Suitable UNIONS: Good solidity on cotton/viscose by method 1		SILK: Suitable WOOL: Suitable FASTNESS WOOL (AATCC): Light 8 Milling 5 Peroxide 3 Stoving 5 Washing 5	**TEXTILE APPLICATION OTHER THAN COTTON**
PAPER: Stock colouration				**NON-TEXTILE USAGE**

C.I. Vat Green	16	17	18	19
C.I. Constitution Number or Chemical Class	Anthraquinone	69010	Anthraquinone	Anthraquinone
Hue Artificial Light	Dull Yellowish Green Yellower	Greenish Grey Redder	Bluish Green Yellower	Olive Yellower and duller
Reaction with conc. sulphuric acid (on cellulose)	Dull Violet	Yellowish Brown	Reddish Violet	Greenish Black
DYEING				
Method	2, (1, 3)	2, (3)	2	2
Vatting Temp. °C	50	50 (Short liquor)	60	60
Dyeing Temp. °C	50	45–50	50–60	50–60
Leuco Alkaline	Reddish Brown	Reddish Brown	Reddish Blue	Grey
Acid	Bluish Red	Brownish Yellow	Red	Black
Substantivity	High	—	High	High
Levelling	Good	Very good	Fairly good	Moderately good
Remarks	Dead cotton covered moderately well	For method 2, reduce NaOH by 20% Dead cotton covered		Take the usual precautions to ensure level dyeings in pale hues
PRINTING				
Direct	√	√	√	√
Coloured Resist	√	√	√	√
White Resist	—	—	—	—
Coloured Discharge	√	√	√	√
White Discharge	×	√	—	√
Flash Ageing	—	—	—	—
Remarks	Moderately suitable for direct printing by the all-in method Not dischargeable	Dischargeable in light and medium depths		Dischargeable in pale hues only
FASTNESS				
Testing Method	ISO	ISO	AATCC	AATCC
Cross Dyeing	4	Good	—	—
Hot Pressing	4	4–5	3	4
Hypochlorite	3–4	4–5	4–5	4–5
Light	6, 6–7, 6–7	6–7, 7, 7	5, 6, 7	7, 7–8, 8
Mercerising	5	4–5	3	5
Peroxide Bleach	4–5	4	3–4	4
Soda Boil	3–4	4–5	—	—
Soda Boil (Hypochlorite)	3	Suitable	—	—
Washing Alteration	3	5	—	—
Staining	5	5	—	—
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON	VISCOSE: Dyes weaker than normal at low temperature, and weaker and duller at high temperature SILK: SUITABLE: FASTNESS SILK (ISO): Degumming 3–4 Light 6, 6–7, 7 Peroxide 5 Washing 5	VISCOSE: For data on strike rate of diffusion, and time of half-dyeing, see *JSDC*, **55** (1939), 481 SILK: Suitable FASTNESS SILK (ISO): Degumming 4–5 Light 6, 6, 6–7 Peroxide 5 Washing 5	WOOL: Suitable FASTNESS WOOL (AATCC): Light —, 6, 7 Milling (III) 3 Washing (III) 3	SILK: Suitable FASTNESS SILK (AATCC): Light 2–3 Peroxide 4–5 Washing (III) 5 WOOL: Suitable FASTNESS WOOL (AATCC): Light 7–8 Milling (III) 4 Washing (III) 3
NON-TEXTILE USAGE				

20	Solubilised 21	22	23	C.I. Vat Green
Anthraquinone Olive Redder and duller	59051 Green Yellower	56015 Olive→Brownish Olive Brighter and yellower	56011 Olive	C.I. Constitution Number or Chemical Class Hue Artificial Light
Dull Reddish Blue	Grey→Brown			Reaction with conc. sulphuric acid (on cellulose)
2 50 50 Dull Reddish Violet Brown High Good	High Dye weakly alkaline at 20–30°C Substantivity increased by addition of NaCl Develop by nitrite (hot or cold)	4 75 50–55 Brownish Olive Pale Yellow High Very good For use on wool and silk when high fastness to light is required	4 Dull Olive	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
× × — — — —	✓ ✓ ✓ × ✓ × Direct prints developed with chlorate, nitrite or bichromate			**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
AATCC — 4 4–5 6, 6–7, 7 4 4 — — — —	ISO — — 5 7, 7–8, 8 — — 4 Suitable — —			**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
WOOL: Suitable FASTNESS WOOL (AATCC): Light 3, 4, —	SILK: Dye weakly acid adding sodium sulphoxylate formaldehyde. Substantivity high. Develop by bichromate WOOL: Dye weakly acid adding ammonium sulphate Develop by bichromate	SILK: Suitable WOOL: Substantivity, high; levelling, good FASTNESS WOOL (ISO): Light 7, 7, 7–8 Milling 5 Peroxide 4–5 Stoving 4–5 Washing 5	WOOL: Suitable FASTNESS WOOL (ISO): Light —, 7–8, — Milling 5 Stoving 4–5 Washing 5	**TEXTILE APPLICATION OTHER THAN COTTON**
				NON-TEXTILE USAGE

C.I. Vat Green	24	25	26	27	28
C.I. Constitution Number or Chemical Class	—		Anthraquinone	Anthraquinone	Anthraquinone
Hue Artificial Light	Green Yellower		Olive Yellower	Dull Brownish Olive Yellower	Dull Yellowish Green Yellower
Reaction with conc. sulphuric acid (on cellulose)					Orange Brown
DYEING Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks	2, (3) 60 50 Golden Yellow Yellow Olive — Very good Soap thoroughly to give the true hue	This C.I. Generic Name is discontinued	2, (1) 50 50 Dull Olive — High Moderately good Can be dyed at higher temperatures (to 90°C) Suitable for covering dead cotton	2, (1) 50 50 Dull Olive — High Moderate Suitable for covering dead cotton	2, (1) 50 40–50 Red Brown Khaki High Good Dead cotton covered
PRINTING Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks	√ √ — √ √ — Dischargeable to white in pale hues		— — — — — √	× × — × — √	√ √ — √ √ √ Dischargeable in pale dyeings ($\frac{1}{3}$ N)
FASTNESS Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks	ISO — 4–5 4–5 6–7, 7, 7–8 4–5 4 4 — 4–5 5		ISO 5 4 4–5 6–7, 7, 7–8 5 5 4–5 4–5 5 4–5	ISO 5 3–4 4–5 6–7, 7, 7–8 4–5 5 4–5 4–5 5 4–5	ISO 5 5 5 6, 6–7, 7 5 5 5 5 5 5
TEXTILE APPLICATION OTHER THAN COTTON			SILK: Suitable by method 2	SILK: Suitable by method 2 FASTNESS SILK (ISO): Degumming 5 Light 6, 6–7, — Washing 5	
NON-TEXTILE USAGE					

29	30	Solubilised 30	31	C.I. Vat Green
Anthraquinone	Anthraquinone	Anthraquinone	Anthraquinone	C.I. Constitution Number or Chemical Class
Olive Yellower	Greenish Olive Yellower		Olive Duller, Browner	Hue Artificial Light
Slightly Bluer	Yellower		Violet	Reaction with conc. sulphuric acid (on cellulose)
2 60 50 Olive Brown Khaki High Good Dyeing temperature should not exceed 50°C Dead cotton covered moderately well	1 60 50–60 Blue Grey Reddish Grey High Good Coverage of dead cotton, moderate	Moderate Dye neutral or weakly alkaline at 60–70°C Develop with nitrite Applicable by the one or two bath processes	2, (3) 50 50 Violet Orange Brown Very high Very good Coverage of dead cotton, poor	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
✓ ✓ — ✓ × —	× × — × — ✓	✓ ✓ ✓ × × × Direct prints by the nitrite process Short steaming prior to H_2SO_4 development gives better yield	✓ ✓ ✓ ✓ ✓ —	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
ISO 5 5 5 7, 7–8, 8 4–5 5 4–5 Suitable 5 5	ISO 4–5 5 5 7–8 ($\frac{1}{12}$ N), 7–8, 8, 8 5 5 4–5 5 5 5		ISO 5 5 4–5 7–8, 7–8, 7–8 4–5 3–4 4–5 Suitable 4–5 5	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
			SILK: Suitable FASTNESS SILK (ISO): Light 7, 7–8, 8 Peroxide 5 Washing 5	**TEXTILE APPLICATION OTHER THAN COTTON**
				NON-TEXTILE USAGE

C.I. Vat Green	32	33	34	35	36-39	40
C.I. Constitution Number or Chemical Class	Anthraquinone	Anthraquinone		Anthraquinone		Anthraquinone
Hue Artificial Light	Brownish Olive	Olive		Olive		Dull Olive Greener
Reaction with conc. sulphuric acid (on cellulose)	Greenish Grey					Dull Olive Green
DYEING			This C.I. Generic Name is discontinued		These C.I. Generic Names are discontinued	
Method	1	2, (3)		1, (2)		1
Vatting Temp. °C	50–60	50		50–60		60
Dyeing Temp. °C	50–60	45–50		50–60		60–90
Leuco Alkaline	Dark Brown	Khaki		Olive		Brownish Olive
Acid	Olive	Brown		Green		Brown
Substantivity	Very high	Moderate		High		—
Levelling	Moderate	Very good		Good		—
Remarks	Coverage of dead cotton, very good	Maximum dyeing temperature 90°C Coverage of dead cotton, poor		Coverage of dead cotton, very good Maximum dyeing temperature 90°C		Suitable for high temperature dyeing Dead cotton covered
PRINTING						
Direct	✓	✓				×
Coloured Resist	✓	✓				×
White Resist	—	—				—
Coloured Discharge	✓	✓				×
White Discharge	×	×				—
Flash Ageing	—	✓				✓
Remarks						
FASTNESS						
Testing Method	ISO	ISO		ISO		ISO
Cross Dyeing	—	—		—		—
Hot Pressing	2–3	3–4		3		5
Hypochlorite	4–5	—		4–5		4–5
Light	7–8, 8, 8	6–7 ($\frac{1}{10}$N) 7, 7–8, 7–8		7, 7–8, 8		7–8, 7–8, 7–8
Mercerising	4–5	4–5		4–5		4
Peroxide Bleach	4–5	4–5		5		4–5
Soda Boil	4–5	4		4		4
Soda Boil (Hypochlorite)	Suitable	Suitable		Suitable		—
Washing Alteration	5	4–5		4–5		4–5
Staining	5	5		5		5
Remarks						
TEXTILE APPLICATION OTHER THAN COTTON	SILK: Suitable, method 2 FASTNESS SILK (ISO): Degumming 4–5 Light 6, 6–7, 7–8 Peroxide 5 Washing 5	SILK: Suitable, method 2 FASTNESS SILK (ISO): Degumming 4–5 Light 6, 6–7, — Washing 5				
NON-TEXTILE USAGE						

41	42	43	44	45,46	C.I. Vat Green
Anthraquinone Olive	Anthraquinone Green	Anthraquinone Dull Bluish Green	Anthraquinone Dull Olive		C.I. Constitution Number or Chemical Class Hue Artificial Light
					Reaction with conc. sulphuric acid (on cellulose)
	1, (2) 50–60 55–60 Blue — — Moderate	1, (2) 50–60 55–60 Dull Blue — — Moderate	1, 2 50 45–50 Brown — — Moderate	These C.I. Generic Names are discontinued	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
✓ ✓ — ✓ — —	✓ ✓ — ✓ ✓ — Moderate dischargeability in pale hues	✓ ✓ — ✓ ✓ — Moderate dischargeability in pale hues	✓ ✓ — ✓ ✓ — Moderate dischargeability in pale hues		**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
ISO — 5 — 7, 7, 7–8 — 4 — — 4–5 5	JIS — 5 (wet) — 5–6, 6, 6–7 4–5 4–5 4–5 — 4–5 5	JIS — 5 (wet) — 7–8, 8, 8 4–5 4–5 4–5 — 4–5 5	JIS — 5 (wet) — 8, 8, 8 4 4–5 4 — 4–5 5		**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
					TEXTILE APPLICATION OTHER THAN COTTON
					NON-TEXTILE USAGE

C.I. Vat Green	47	48	
C.I. Constitution Number or Chemical Class	Anthraquinone	Anthraquinone	
Hue Artificial Light	Dark Bluish Green Brighter	Olive Yellower	
Reaction with conc. sulphuric acid (on cellulose)	Black		
DYEING			
Method	—	1, (Special)	
Vatting Temp. °C	—	60	
Dyeing Temp. °C	—	50–60	
Leuco Alkaline	Dark Grey Violet	Red	
Acid	Dark Grey	Red Violet	
Substantivity	—	High	
Levelling	—	Good	
Remarks	Applied by conventional batch and continuous methods	Satisfactory coverage of dead cotton	
PRINTING			
Direct			
Coloured Resist			
White Resist			
Coloured Discharge			
White Discharge			
Flash Ageing			
Remarks			
FASTNESS			
Testing Method	AATCC	ISO	
Cross Dyeing	—	—	
Hot Pressing	—	3	
Hypochlorite	3–4	4	
Light	—, 7–8, —	6–7, 7, 7–8	
Mercerising	—	4–5	
Peroxide Bleach	2	4	
Soda Boil	—	3–4	
Soda Boil (Hypochlorite)	—	—	
Washing Alteration	4–5 (III)	4	
Staining	4–5 (III)	4–5	
Remarks			
TEXTILE APPLICATION OTHER THAN COTTON			
NON-TEXTILE USAGE			

C.I. Vat Brown	1	1:1	Solubilised 1	2	3	3:1	Solubilised 3
C.I. Constitution Number or Chemical Class	70800		70801		69015		69016
Hue Artificial Light	Reddish Brown Brighter				Brown Redder		
Reaction with conc. sulphuric acid (on cellulose)	Greenish Black				Black		
DYEING							
Method	2, (3)	USAGE/PROPERTIES: Similar to C.I. Vat Brown 1 Slightly different chemically		This C.I. Generic Name is discontinued	2, (3)	Purified form of C.I. Vat Brown 3	
Vatting Temp. °C	50				≯50		
Dyeing Temp. °C	50				≯50		
Leuco Alkaline	Yellowish Brown				Reddish Brown		
Acid	Dull Olive				Yellowish Brown		
Substantivity	High		Fairly high		High		Moderate
Levelling	Very good				Very good		
Remarks			Dye neutral or weakly alkaline at 60–70°C Substantivity improved by adding NaCl Develop with nitrite Applicable by the one-bath method developing at 30°C		For data on strike, levelling and migration, see *JSDC*, **66** (1950), 505		Dye weakly alkaline at 40°C. Exhaust with NaCl not exceeding 20 g/l Develop with nitrite Applicable by the one-bath process developing at 40°C
PRINTING							
Direct	×		✓		✓		✓
Coloured Resist	×		✓		✓		✓
White Resist	—		✓		✓		✓
Coloured Discharge	×		×		✓		×
White Discharge	✓		✓		✓		✓
Flash Ageing	✓		×		✓		×
Remarks	Dischargeable in pale dyeings only		Dischargeable in pale dyeings only				Direct prints developed with nitrite, sulphocyanide or chromate

FASTNESS	AATCC	ISO	AATCC	ISO
Testing Method				
Cross Dyeing	4–5	5	5	5
Hot Pressing	5	5	5	5
Hypochlorite	5	4–5	5	5
Light	7, 8, 8	6–7, 7, 7–8	7, 7–8, 8	6–7, 7, 7
Mercerising	4–5	4–5	4–5	4–5
Peroxide Bleach	4–5	4–5	4–5	4–5
Soda Boil	4–5	4–5	4–5	4–5
Soda Boil (Hypochlorite)	4–5	4–5	4–5	5
Washing Alteration	—	5	—	5
Staining	—	5	—	5
Remarks				

TEXTILE APPLICATION OTHER THAN COTTON	VISCOSE: For data on strike, see *JSDC*, **55** (1939), 496 SILK: Substantivity, high; levelling, very good FASTNESS SILK (ISO): Degumming 4–5 Light 6–7, 7, 7–8, 7–8 Peroxide 5 Washing 5 UNIONS: Good solidity on cotton/viscose dyed at 30°C		SILK: Weakly acid, adding sodium formaldehyde-sulphoxylate Develop with bichromate WOOL: Weakly acid with ammonium sulphate. Develop with bichromate ACETATE: Strongly acid, adding sodium formaldehyde-sulphoxylate. Develop with nitrite		VISCOSE: For data on strike, rate of diffusion and time of half-dyeing, see *JSDC*, **55** (1939), 481 SILK: Levelling good FASTNESS SILK (ISO): Degumming 4 Light 7, 7–8, 7–8 Peroxide 5 Washing 5 WOOL: Suitable UNIONS: Good solidity cotton/viscose dyed cold		SILK: Dye neutral adding NaCl or weakly acid adding ammonium acetate and sodium formaldehyde-sulphoxylate Develop in both cases by sulphocyanide-dichromate method ACETATE: Dye strongly acid adding sodium formaldehyde-sulphoxylate. Develop with nitrite
NON-TEXTILE USAGE	PAPER: Stock colouration				See C.I. Pigment Brown 28		

C.I. Vat Brown	4	5	Solubilised 5
C.I. Constitution Number or Chemical Class	—	73410	73411
Hue Artificial Light	Reddish Brown Yellower	Brown→Reddish Brown Much Redder	
Reaction with conc. sulphuric acid (on cellulose)		Blue	
DYEING			
Method		4, (2)	
Vatting Temp. °C		60–80	
Dyeing Temp. °C		50–60	
Leuco Alkaline		Reddish Yellow	
Acid		Pale Brown	
Substantivity		Moderate	Poor
Levelling		Moderate	
Remarks		Thorough soaping necessary to develop the true hue	Dye neutral or weakly alkaline at 20–30°C Substantivity improved by adding NaCl, but avoid excess or pptn. results Develop with nitrite (hot or cold)
PRINTING			
Direct	✓	✓	✓
Coloured Resist	✓	✓	✓
White Resist	—	✓	✓
Coloured Discharge	✓	✓	—
White Discharge	—	✓	✓
Flash Ageing	—	✓	×
Remarks			Direct prints developed with chlorate, nitrite or bichromate
FASTNESS			
Testing Method	ISO	AATCC	ISO
Cross Dyeing	—	5	5
Hot Pressing	—	4	3
Hypochlorite	4	4–5	4
Light	6–7, 7, 7–8	5, 5–6, 6–7	5–6, 6–7, 7
Mercerising	—	5	4
Peroxide Bleach	—	4–5	4–5
Soda Boil	—	5	3–4
Soda Boil (Hypochlorite)	—	5	4–5
Washing Alteration	4–5	—	4–5
Staining	—	—	5
Remarks		Accelerates tendering on exposure to light	
TEXTILE APPLICATION OTHER THAN COTTON		VISCOSE: For data on strike, see *JSDC*, **55** (1939), 481 SILK: Substantivity high FASTNESS SILK (ISO): Degumming 4 Light 5–6, 6–7, 7 Peroxide 5 Washing 5 WOOL: Suitable FASTNESS WOOL (ISO): Light 7–8, 8, 8 Milling 5 Peroxide 5 Stoving 5 Washing 5	SILK: Dye weakly acid, adding sodium formaldehyde-sulphoxylate Develop with bichromate WOOL: Dye acid with ammonium sulphate. Develop with bichromate ACETATE: Dye strongly acid adding sodium formaldehyde-sulphoxylate Develop with nitrite
NON-TEXTILE USAGE		See C.I. Pigment Brown 27	

6	Solubilised 6	Solubilised 7	8	C.I. Vat Brown
Anthraquinone	Anthraquinone	73406	70810	C.I. Constitution Number or Chemical Class
Dull Brown Greener		Dull Reddish Brown Redder and brighter	Reddish Brown Brighter and redder	Hue Artificial Light
		Dull Blue	Reddish Black	Reaction with conc. sulphuric acid (on cellulose)
2, (1) 50 40–50 Yellowish Brown Olive Moderately high Very good	High Dye neutral or weakly alkaline Develop with nitrite	Poor Dye neutral or weakly alkaline at 20–30°C, adding NaCl Develop by nitrite (hot)	1+, (1, 2) 50 50–60 Wine Red Yellowish Brown — Good For method 2, increase NaOH by 15% Dead cotton covered	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
× × — × × —	√ √ √ × × ×	√ √ — × × × Direct prints developed by chlorate, nitrite or bichromate	√ √ — √ × —	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
AATCC / ISO — / 5 5 / 4 5 / 5 —, 7–8, — / 7, 7–8, 8 3 / 3 5 / 4 — / 4 — / 4 — / 5 — / 5		ISO — — 4 5–6, 6, 6–7 — — 3 Unsuitable 4 —	ISO Good 4 4 7, 7, 7 3 5 4 Suitable 4–5 5	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
VISCOSE: Dyes weaker than cotton at 50°C. Dyes best at 80°C SILK: Suitable	SILK: Dye weakly acid. Develop with bichromate WOOL: Dye weakly acid, adding sodium formaldehyde-sulphoxylate. Develop with bichromate FASTNESS WOOL (ISO): Light 7–8, 8, 8 Milling 4; Washing 4 ACETATE: Dye strongly acid, adding sodium formaldehyde-sulphoxylate. Develop with nitrite		VISCOSE: Best dyed at 80°C SILK: Suitable FASTNESS SILK (ISO): Degumming 4 Light 6, 6–7, 7 Peroxide 4–5 Washing 5	**TEXTILE APPLICATION OTHER THAN COTTON**
				NON-TEXTILE USAGE

C.I. Vat Brown	9	10	11	12
C.I. Constitution Number or Chemical Class	71025	Anthraquinone	Anthraquinone	Anthraquinone
Hue Artificial Light	Dull Yellowish Brown Redder	Reddish Brown Yellower	Reddish Brown Slightly Yellower	Reddish Brown Yellower
Reaction with conc. sulphuric acid (on cellulose)	Blue	Greenish Brown	Olive	Reddish Brown
DYEING				
Method	1, (1+)	1, (2)	1, (2)	1
Vatting Temp. °C	60	60	60	60
Dyeing Temp. °C	60	50–60	50–60	60
Leuco Alkaline	Reddish Brown	Brown	Reddish Brown	Reddish Black
Acid	Dark Brown	Yellowish Brown	Yellowish Brown	Reddish Brown
Substantivity	High	High	High	High
Levelling	Fairly good	Moderate	Good	Good
Remarks	Dead cotton covered	Dead cotton covered	Dead cotton covered	
PRINTING				
Direct	×	√	√	√
Coloured Resist	×	×	√	√
White Resist	—	—	—	—
Coloured Discharge	×	×	√	√
White Discharge	×	—	—	—
Flash Ageing	—	—	—	—
Remarks		Suitable for direct printing in pale hues only		
FASTNESS				
Testing Method	ISO	AATCC	AATCC	AATCC
Cross Dyeing	Very good	—	—	—
Hot Pressing	4–5	4	5	4
Hypochlorite	4–5	3–4	4	4–5
Light	6–7, 7, 7	4, 4–5, 5	5–6, 6–7, 7	5, 6, 7
Mercerising	4–5	4–5	5	4
Peroxide Bleach	4–5	3–4	4–5	4
Soda Boil	4–5	4–5	4–5	—
Soda Boil (Hypochlorite)	Suitable	3–4	4	—
Washing Alteration	5	—	—	—
Staining	5	—	—	—
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON	SILK: Substantivity, moderately high; levelling, very good FASTNESS SILK (ISO): Degumming 4 Light 5–6, 6, 6–7 Peroxide 4–5 Washing 5 UNIONS: Good solidity on cotton/viscose			SILK: Suitable FASTNESS SILK (AATCC): Light 4 Peroxide 4 Washing (III) 4–5 WOOL: Suitable FASTNESS WOOL (AATCC): Light 3
NON-TEXTILE USAGE				

13	14	15	16	C.I. Vat Brown
Anthraquinone	71120	Anthraquinone	70910	C.I. Constitution Number or Chemical Class
Dull Yellowish Brown Yellower	Reddish Brown Brighter	Dull Reddish Violet Redder	Brownish Olive Redder	Hue Artificial Light
Violet	Dull Red			Reaction with conc. sulphuric acid (on cellulose)
1, (2) 60 50–60 Reddish Brown Yellowish Brown Very high Good Dead cotton covered	1 60–70 60 Olive Reddish Brown High Good	1 50–60 60 Dull Blue Bordeaux High Good	1, (2) 60 50–60 Reddish Brown Yellowish Brown — Very good High conc. of NaOH is necessary For method 1, addition of NaCl is required	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
✓ ✓ — ✓ — —	✓ ✓ ✓ ✓ × —	✓ ✓ — ✓ × —	× × — × × —	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
AATCC — 5 4–5 6, 6–7, 7 4–5 4–5 4–5 4–5 — —	ISO Very good 4–5 4 6, 6–7, 7 5 5 5 Suitable — —	ISO — 5 5 7, 7–8, 7–8 4–5 5 5 Suitable — —	ISO Good 5 4–5 6–7, 7, 7–8 4–5 5 4–5 Suitable — —	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
		SILK: Suitable	SILK: Suitable FASTNESS SILK (ISO): Degumming 4–5 Light 6, 6–7, 6–7 Peroxide 5 Washing 5	**TEXTILE APPLICATION OTHER THAN COTTON**
				NON-TEXTILE USAGE

C.I. Vat Brown	17	18	19	20	21
C.I. Constitution Number or Chemical Class	Anthraquinone		Anthraquinone	Anthraquinone	56016
Hue Artificial Light	Dull Yellowish Brown Redder		Brownish Olive Redder	Dull Reddish Brown Unchanged	Brown Yellower
Reaction with conc. sulphuric acid (on cellulose)				Blue	
DYEING		This C.I. Generic name is discontinued			
Method	1, (2)		1, (1+, 2)	2, (3)	4
Vatting Temp. °C	60		60	45–50	65
Dyeing Temp. °C	60		50–60	45–50	50–55
Leuco Alkaline	Dull Brown		Black Brown	Reddish Violet	Yellowish Brown
Acid	Dull Brown		Black Brown (redder)	Orange	Pale Yellow
Substantivity	High		Low	High	High
Levelling	Fairly good		Good	Good	Very good
Remarks	Dead cotton covered very well		Dead cotton covered		
PRINTING					
Direct	×		×	×	×
Coloured Resist	×		×	×	×
White Resist	—		×	—	—
Coloured Discharge	×		×	×	×
White Discharge	×		✓	✓	—
Flash Ageing	—		—	—	—
Remarks			Dischargeable under strongly alkaline conditions	Dischargeable in pale hues only	
FASTNESS					
Testing Method	ISO		ISO	AATCC	
Cross Dyeing	Very good		5	—	
Hot Pressing	4		5	5	
Hypochlorite	4–5		5	4–5	
Light	6–7, 7, 7–8		7, 7–8, 8	6, 7, —	
Mercerising	4–5		4	5	
Peroxide Bleach	5		5	4–5	
Soda Boil	4–5		4–5	—	
Soda Boil (Hypochlorite)	Suitable		Suitable	4–5	
Washing Alteration	5		5	—	
Staining	5		5	—	
Remarks					
TEXTILE APPLICATION OTHER THAN COTTON	VISCOSE: Low substantivity; levelling, moderate SILK: Substantivity, moderate; levelling, good FASTNESS SILK (ISO): Degumming 4 Light 6, 6–7, 7 Peroxide 5 Washing 5		SILK: Suitable FASTNESS SILK (ISO): Degumming 5 Light 6, 6–7, 7 Peroxide 5		SILK: Suitable WOOL: Substantivity, high; levelling, good FASTNESS WOOL (ISO): Light 7, 7–8, 7–8 Milling 5 Peroxide 5 Stoving 4–5 Washing 5
NON-TEXTILE USAGE					

22	23	24	25	C.I. Vat Brown
71115 Reddish Brown Redder	**65250** Dull Brown Redder	**56010** Brown Yellower	**69020** Reddish Brown Redder	C.I. Constitution Number or Chemical Class Hue Artificial Light
Yellowish Red	Brownish Black		Violet	Reaction with conc. sulphuric acid (on cellulose)
1 60 60 Olive Brown High Good	1, (2) 60 60 Grey Dull Violet High Good Dead cotton covered	4 65 50–55 Yellowish Brown Pale Yellow — —	2, (3) 50 45–50 Reddish Brown Brown High Good	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
✓ ✓ ✓ ✓ × —	✓ ✓ ✓ ✓ × —	× × — × — —	✓ ✓ — ✓ ✓ — Dischargeable in pale and medium hues only	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
ISO Very good 5 5 6–7, 7, 7 5 5 4–5 Suitable — —	AATCC ISO 4–5 5 5 4 1 1–2 4–5, —, — 5, 5–6, 5–6 4–5 4–5 1 2 — 3 — Unsuitable — 4–5 — 2		AATCC ISO 5 Good 5 5 5 5 6–7, 7–8, 8 6–7, 7, 7 5 5 5 5 4–5 4–5 4–5 Suitable — 5 — 5	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
	SILK: Substantivity, moderate; levelling, good FASTNESS SILK (ISO): Degumming 2–3 Light 5, 5–6, 6 Peroxide 5 Washing 5	SILK: Suitable WOOL: Substantivity, high; levelling, very good FASTNESS WOOL (ISO): Light 7, 7–8, 7–8 Milling 5 Peroxide 4–5 Stoving 4–5 Washing 5	VISCOSE: For data on strike, see *JSDC*, **55** (1939), 496 SILK: Suitable FASTNESS SILK (ISO): Degumming 4–5 Light 7, 7, 7–8 Peroxide 5 Washing 5	**TEXTILE APPLICATION OTHER THAN COTTON**
			PAPER: Stock colouration	**NON-TEXTILE USAGE**

C.I. Vat Brown	26	27	28	29
C.I. Constitution Number or Chemical Class	70510	Anthraquinone	Anthraquinone	Anthraquinone
Hue Artificial Light	Dull Brown Greener	Dull Reddish Brown Yellower	Reddish Brown Brighter and redder	Reddish Brown
Reaction with conc. sulphuric acid (on cellulose)	Greenish Blue	Dull Olive	Dull Bluish Violet	Green
DYEING				
Method	2, (3)	2	2	2
Vatting Temp. °C	50 (short liquor)	50	50	50
Dyeing Temp. °C	45–50	50	50	50
Leuco Alkaline	Yellowish Brown	Dull Orange	Dull Reddish Brown	Brown
Acid	Yellowish Brown	Dull Olive	Dull Bluish Red	Chocolate
Substantivity	—			High
Levelling	Very good			Very good
Remarks	Method 3 for shading only			Reduce NaOH and increase NaCl to obtain maximum exhaustion
PRINTING				
Direct	✓		✓	✓
Coloured Resist	✓		✓	—
White Resist	—		—	—
Coloured Discharge	✓		✓	—
White Discharge	×		×	—
Flash Ageing	—		✓	—
Remarks				Suitable for pale prints only
FASTNESS				
Testing Method	ISO	ISO	ISO	AATCC
Cross Dyeing	Good	5	—	—
Hot Pressing	4–5	5	—	—
Hypochlorite	5	4–5	5	5
Light	7, 7–8, 7–8	7, 7–8, 8	6–7, 6–7, 7	6, 7, 7
Mercerising	5	4–5	—	3
Peroxide Bleach	4–5	4–5	—	5
Soda Boil	4–5	4–5	—	—
Soda Boil (Hypochlorite)	Suitable	Suitable	—	—
Washing Alteration	5	—	4–5	—
Staining	5	—	—	—
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON	SILK: Suitable FASTNESS SILK (ISO): Degumming 3 Light 6–7, 7, 7 Peroxide 5 Washing 5		SILK: Suitable UNIONS: Fairly good solidity on cotton/viscose	
NON-TEXTILE USAGE	PAPER: Stock colouration	PAPER: Stock colouration		

30	31	32	Solubilised 32	C.I. Vat Brown
Anthraquinone	70695	Anthraquinone	Anthraquinone	C.I. Constitution Number or Chemical Class
Dull Yellowish Brown Redder	Reddish Brown Brighter and yellower	Reddish Brown Redder		Hue Artificial Light
Dull Green	Olive			Reaction with conc. sulphuric acid (on cellulose)
2, (1, 3) 50 50 Reddish Brown Yellow High Very good Dead cotton covered For method 1, the temperature should not exceed 50°C	2, (1, 3) 50–60 45–50 Reddish Brown Brown High Very good Dead cotton covered	2, (1) 50 40–50 Yellowish Brown Brown — Moderately good Method 1 for shading only	For padding and exhaustion methods	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
× × — × — —	√ √ — √ × —	× × — × × —	√ √ — × × × For deep prints additions of urea and ethylene thiodiglycol required	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
ISO 5 Yellower 4–5 6–7, 6–7, 7 4–5 5 4–5 4 5 4–5	AATCC ISO 4 Good 5 4–5 4 4 4, 5, 6 5–6, 6, 6–7 4 4 3 3–4 4 3–4 — Suitable — 3–4 — 5	AATCC ISO — 5 5 5 4 4–5 —, 7–8, — 7–8, 7–8, 8 4 4 4 4–5 — 4–5 — 4–5 — 5 — 5		**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
VISCOSE: Low substantivity at low temperatures SILK: Suitable FASTNESS SILK (ISO): Degumming 4–5 Light 6–7, 6–7, 7 Peroxide 5 Washing 5 UNIONS: Good solidity on cotton/viscose at 50°C	SILK: Substantivity, high; levelling, good FASTNESS SILK (ISO): Degumming 3–4 Light 5–6, 6, 7 Peroxide 5 Washing 5 UNIONS: Good solidity on cotton/viscose	SILK: Suitable	SILK: Suitable WOOL: Suitable	**TEXTILE APPLICATION OTHER THAN COTTON**
				NON-TEXTILE USAGE

C.I. Vat Brown	33	34	35	36
C.I. Constitution Number or Chemical Class	Anthraquinone	56010	Anthraquinone	Anthraquinone
Hue Artificial Light	Dull Reddish Brown Greener	Dull Brownish Olive Redder	Brown→Yellowish Brown Yellower and brighter	Reddish Brown Yellower
Reaction with conc. sulphuric acid (on cellulose)				
DYEING				
Method	2, (1)	4	2, (1, 3)	2, (1, 3)
Vatting Temp. °C	50	75	50	50
Dyeing Temp. °C	40–50	50–55	40–50	40–50
Leuco Alkaline	Dull Olive	Brownish Olive	Reddish Brown	Reddish Orange
Acid	Olive	Pale Yellow	Yellowish Brown	Yellowish Brown
Substantivity	Moderate		Moderate	Moderate
Levelling	Moderately good		Good	Good
Remarks				Methods 1 and 3 for shading only
PRINTING				
Direct	×	×	×	×
Coloured Resist	×	×	×	×
White Resist	—	—	—	—
Coloured Discharge	×	×	×	×
White Discharge	×	×	—	—
Flash Ageing	—	—	—	—
Remarks				
FASTNESS				
Testing Method	ISO		AATCC ISO	ISO
Cross Dyeing	5		— —	—
Hot Pressing	4		5 5	4
Hypochlorite	3–4		4 4–5	5
Light	7, 7–8, 8		—, 7–8, — 7, 7–8, 8	7, 7–8, 7–8
Mercerising	4–5		4 4	—
Peroxide Bleach	4		5 5	5
Soda Boil	4–5		— 4	4–5
Soda Boil (Hypochlorite)	3–4		— 4	—
Washing Alteration	5		— 4–5	5
Staining	5		— 5	5
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON	VISCOSE: Best dyed at 80°C. Weaker dyeings at lower temperatures SILK: Suitable	SILK: Suitable WOOL: Substantivity, high; levelling, very good FASTNESS WOOL (ISO): Light 7, 7, 7–8 Milling 5 Peroxide 4–5 Stoving 4–5 Washing 5	VISCOSE: Best dyed at 80°C. Much weaker dyeings at 40°C SILK: Suitable when retarding agent added	
NON-TEXTILE USAGE				

37	37:1	38	Solubilised 38	39	C.I. Vat Brown
56012		Anthraquinone	Anthraquinone	59270	C.I. Constitution Number or Chemical Class
Brown		Reddish Brown Unchanged		Reddish Brown Brighter and yellower	Hue Artificial Light
		Dull Blue		Dull Bluish Red	Reaction with conc. sulphuric acid (on cellulose)
4 65 55 Yellowish Brown Colourless	USAGE/PROPERTIES: Similar to C.I. Vat Brown 37 Slightly different chemically	2, (1) 50 50 Dull Brown Greenish Yellow High Good Dead cotton covered moderately well	Moderate	2, (1) 50 50 Violet Reddish Brown High Good	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
× × — × — —		✓ × — × × ✓ In direct printing by the all-in process, suitable for pale prints only	✓ ✓ ✓ × × × Direct prints by chlorate, nitrite or sulphocyanide process	✓ ✓ — ✓ × —	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
		ISO 4–5 Slightly Yellower 4 6–7, 7, 7 5 5 4–5 Suitable 5 5		ISO — 5 4 5–6, 6, 6–7 3 4–5 4 Suitable 4–5 5	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
WOOL: Substantivity high; levelling, very good FASTNESS WOOL (ISO): Light 6, 7, 7–8 Milling 5 Peroxide 4 Stoving 4–5 Washing 5		VISCOSE: Low substantivity at low temperatures Dyes slightly yellower at high temperature SILK: Suitable FASTNESS SILK (ISO): Degumming 4–5 Light 6, 6–7, 6–7 Peroxide 4–5 Washing 4–5 UNIONS: Good solidity, cotton/viscose dyed cold; viscose heavier at 50°C			**TEXTILE APPLICATION OTHER THAN COTTON**
					NON-TEXTILE USAGE

C.I. Vat Brown	40	41	42	43	44
C.I. Constitution Number or Chemical Class	Anthraquinone	Anthraquinone	73665		70802
Hue Artificial Light	Reddish Brown Redder and brighter	Dull Reddish Brown Slightly Yellower	Brown Redder		Reddish Brown Brighter
Reaction with conc. sulphuric acid (on cellulose)	Reddish Brown		Yellowish Brown		Yellowish Brown
DYEING Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks	 2 50 50 Greenish Black Yellowish Brown Very high Good	 2, (1) 50 50 Reddish Brown Brown	 4 70 50 Yellowish Orange Yellow High Good	This C.I. Generic Name is discontinued	 2, (1, 3) 45–50 50 Reddish Brown Dull Yellow Moderate Very good For method 1, addn. of NaCl required
PRINTING Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks	 √ √ — √ √ — Dischargeable in pale and medium hues	 √ √ — √ — —	 √ √ √ √ — —		 × × — × × —
FASTNESS Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks	 AATCC — 3 4–5 6, 7, — 4–5 3–4 — — — —	 ISO — 5 4–5 6, 6–7, 7 4 4–5 4 Suitable 4–5 5	 ISO Good 4 4–5 5, 6, 6 4 5 4 Suitable — — Accelerates tendering on exposure to light		 ISO — 5 4 6–7, 7, 7–8 4 4–5 4–5 Suitable 4–5 5
TEXTILE APPLICATION OTHER THAN COTTON	WOOL: Suitable FASTNESS WOOL: (AATCC) Light 4, 5, 6 Milling (III) 3 Washing (III) 4		SILK: Suitable WOOL: Substantivity, high FASTNESS WOOL (ISO): Light 7–8, 7–8, 8 Milling 5 Peroxide 4 Stoving 4 Washing 5		VISCOSE: For data on strike, rate of diffusion and time of half-dyeing, see *JSDC*, **55** (1939), 481 SILK: Substantivity, poor, levelling, good FASTNESS SILK (ISO): Degumming 4 Light 4, 5, 6 Peroxide 5 Washing 5
NON-TEXTILE USAGE					

45	46	47	48	49	C.I. Vat Brown
59500 Reddish Brown Redder and brighter		Anthraquinone Yellowish Brown Slightly redder	Indigoid Brown Redder	Anthraquinone Dull Brownish Olive Slightly Redder	C.I. Constitution Number or Chemical Class Hue Artificial Light
Blue		Dull Violet	Violet	Dull Violet	Reaction with conc. sulphuric acid (on cellulose)
2, (1, 3) 50 45–50 Yellowish Brown Yellowish Brown Poor Very good	This C.I. Generic Name is discontinued	2, (1) 50 50 Reddish Brown Greenish Yellow High Very good Dead cotton covered moderately well	2, 4 90 50–60 Yellowish Brown Colourless Moderate Good	2, (1) 50 50 Reddish Brown Yellow Poor Very good Dead cotton covered moderately well	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
× × — × ✓ —		× × — × × —	✓ ✓ ✓ ✓ ✓ — In direct printing, anthraquinone improves colour yield	× × — × × —	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
ISO Very good 4 4–5 7, 7–8, 8 4–5 4–5 3–4 Suitable 5 5		ISO 5 Slightly Yellower 4–5 6, 6–7, 7 Slightly Greener 5 4 4 4–5 4–5	ISO — 4 5 4–5, 5–6, 6 4 5 3 — 4–5 5	ISO 5 5 4 6–7, 6–7, 7 5 5 4 3–4 5 5	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
SILK: Substantivity, poor; levelling, very good FASTNESS SILK (ISO): Degumming 3–4 Light 6–7, 7, 7 Peroxide 5 Washing 5		VISCOSE: Low substantivity at low temperatures UNIONS: On cotton/viscose, viscose dyes slightly weaker than cotton at 50°C, and much weaker dyed cold		VISCOSE: Low substantivity at low temperatures. Dyes slightly yellower than normal at high temperature UNIONS: Good solidity on cotton/viscose at 50°C	**TEXTILE APPLICATION OTHER THAN COTTON**
					NON-TEXTILE USAGE

C.I. Vat Brown	50	51	52	53
C.I. Constitution Number or Chemical Class	Anthrimide	Anthraquinone	Anthraquinone	
Hue Artificial Light	Brown Redder	Bright Reddish Brown Yellower	Reddish Brown	Reddish Brown Yellower
Reaction with conc. sulphuric acid (on cellulose)	Greenish Blue	Olive Brown		Greenish Blue
DYEING				
Method	2	2	2	2
Vatting Temp. °C	50	50	60	50
Dyeing Temp. °C	45–50	50	60	45–50
Leuco Alkaline	Violet	Brown	Reddish Brown	Yellow
Acid	Brown	Brown	Yellowish Brown	Colourless
Substantivity	—	High	Moderate	High
Levelling	Very good	Good	Good	Very good
Remarks	Poor coverage of dead cotton		Dead cotton covered	Suitable for high temperature dyeing
PRINTING				
Direct	×	√	×	
Coloured Resist	×	—	×	
White Resist	—	—	—	
Coloured Discharge	×	—	×	
White Discharge	—	×	×	
Flash Ageing	√	—	√	
Remarks		In direct printing, suitable for pale hues only		
FASTNESS				
Testing Method	ISO	AATCC	AATCC	AATCC
Cross Dyeing	5	—	—	—
Hot Pressing	5	5	4–5	5
Hypochlorite	4–5	2	4	3–4
Light	7–8, 7–8, 7–8	—, 4–5, —	—, 5–6, 6–7	5, 6, 6–7
Mercerising	4	—	4	5
Peroxide Bleach	5	3	4–5	4
Soda Boil	4–5	—	4	—
Soda Boil (Hypochlorite)	Suitable	—	—	—
Washing Alteration	4–5	3–4	4–5	4–5 (III)
Staining	5	—	5	5 (III)
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON		WOOL: Suitable		SILK: Suitable
NON-TEXTILE USAGE				

54	55	56	57	58	C.I. Vat Brown
	70905 Brown Slightly Yellower	Anthraquinone Dull Reddish Brown	Aminoketone Brown Unchanged	Anthraquinone Reddish Brown	C.I. Constitution Number or Chemical Class Hue Artificial Light
					Reaction with conc. sulphuric acid (on cellulose)
This C.I. Generic Name is discontinued	2, (1) 60 45–50 (max. 90) Reddish Brown Yellowish Brown Moderate Moderate Satisfactory coverage of dead cotton	1, (2) 60 50–60 Violet Brown — Fair Satisfactory coverage of dead cotton Maximum dyeing temperature 90°C		1, (2) 60 60–70 Green (brown fluorescence) Olive Green Moderate Good Poor coverage of dead cotton	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
	✓ ✓ — ✓ — ✓	✓ ✓ — ✓ × ✓	✓ ✓ — ✓ — ✓		**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
	ISO — 4–5 — 6, 7, 7–8 4–5 5 4–5 Suitable 4–5 5	ISO — 4–5 — 6, 7, 7–8 4–5 5 4–5 Suitable 4–5 5	ISO — — 4–5 7, 7–8, 7–8 — — — — 5 4	ISO — 4 4–5 6–7, 7, 7–8 2 4 3–4 Unsuitable 4–5 4–5	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
	SILK: Suitable, method 2 FASTNESS SILK (ISO): Degumming 4–5, 4–5, 5 Light 6–7, 7, 7 Washing 4–5, 4–5, 5				**TEXTILE APPLICATION OTHER THAN COTTON**
					NON-TEXTILE USAGE

C.I. Vat Brown	59-64	65	66,67	68	69	70
C.I. Constitution Number or Chemical Class		Anthraquinone		Anthraquinone	Anthraquinone	
Hue Artificial Light		Reddish Brown		Yellowish Brown	Brownish Olive	Brown
Reaction with conc. sulphuric acid (on cellulose)				Olive Green	Olive Green	Bluish Violet
DYEING						
Method	These C.I. Generic Names are discontinued		These C.I. Generic Names are discontinued	1, 2, (3)	1, 2, 3	1, 2, (3)
Vatting Temp. °C				50	60	50–60
Dyeing Temp. °C				45–50	60	50–60
Leuco Alkaline				Reddish Brown	—	Reddish Violet
Acid				—	—	Yellow
Substantivity				—	—	High
Levelling				Good	—	Moderate
Remarks				May hydrolyse, should dyeing temperature be too high		Dead cotton covered
PRINTING						
Direct		✓		✓		×
Coloured Resist		✓		✓		×
White Resist		—		—		—
Coloured Discharge		✓		✓		×
White Discharge		✓		✓		×
Flash Ageing		—		—		✓
Remarks						
FASTNESS						
Testing Method		ISO		JIS	AATCC	ISO
Cross Dyeing		—		—	—	4
Hot Pressing		5		4–5	—	5
Hypochlorite		4		4–5	—	4–5
Light		7, 7, 7–8		7, 7, 7	—, 4, —	6–7, 6–7, 7
Mercerising		5		4–5	—	4
Peroxide Bleach		4–5		5	3	4–5
Soda Boil		—		4	—	4–5
Soda Boil (Hypochlorite)		4		—	—	4–5
Washing Alteration		—		4–5	4–5	—
Staining		—		5	—	—
Remarks						
TEXTILE APPLICATION OTHER THAN COTTON						
NON-TEXTILE USAGE						

71	72	73	74-78	79	C.I. Vat Brown
	Anthraquinone Brown	Anthraquinone Reddish Brown		Anthraquinone Brown Redder	C.I. Constitution Number or Chemical Class Hue Artificial Light
Brownish Violet					Reaction with conc. sulphuric acid (on cellulose)
1, 2, (3) 50–60 50–60 Reddish Brown Yellowish Brown High Very good Dead cotton covered moderately well	2 50 45–50 Reddish Brown — — — May hydrolyse, should dyeing temperature be too high	2, (1) 50 45–50 Dark Brown — — Good	These C.I. Generic Names are discontinued	1+, 2, (3) 60 45–115°C Yellowish Brown Yellowish Brown High Good Dead cotton covered moderately well	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
× × — × √ √ Dischargeable in pale dyeings only	√ √ — √ √ —	√ √ — √ √ — Dischargeability moderate			**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
ISO 4–5 5 4–5 6–7, 7, 7 4 4–5 4–5 4–5 — —	JIS — 4–5 4–5 7, 7, 7–8 4–5 5 4 — 4–5 5	JIS — 4–5 4–5 7–8, 7–8, 8 4 4–5 4 — 4–5 5		ISO 4–5 5 4–5 6–7, 7, 7–8 4–5 4–5 4–5 Suitable — —	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
				SILK: Suitable	**TEXTILE APPLICATION OTHER THAN COTTON**
					NON-TEXTILE USAGE

C.I. Vat Black	1	1:1	Solubilised 1	2	Solubilised 2
C.I. Constitution Number or Chemical Class	73670		73671	73830	73831
Hue Artificial Light	Bluish Grey→Bluish Black Greener and duller			Bluish Grey→Bluish Black Greener	
Reaction with conc. sulphuric acid (on cellulose)	Black, bleeds bluish green				
DYEING					
Method	4				
Vatting Temp. °C	70–80				
Dyeing Temp. °C	40–50				
Leuco Alkaline	Golden Yellow				
Acid	Pale Yellow				
Substantivity	High		Moderate		Poor
Levelling	Very good				
Remarks		Usage/properties: Similar to C.I. Vat Black 1 Slightly different chemically	Dye neutral or weakly alkaline at 20–30°C, adding NaCl. Develop nitrite (hot or cold) Also applicable one-bath method developing at 30°C		Dye neutral or weakly alkaline at 20–30°C adding NaCl. Develop nitrite (hot or cold) Avoid over-development
PRINTING					
Direct	√		√	√	√
Coloured Resist	√		√	√	√
White Resist	√		√	—	√
Coloured Discharge	√		×	√	×
White Discharge	√		√	√	√
Flash Ageing	√		×	—	×
Remarks			Direct prints developed chlorate, nitrite or bichromate		Direct prints developed chlorate, nitrite or bichromate
FASTNESS					
Testing Method	AATCC	ISO		ISO	
Cross Dyeing	4	Suitable		Suitable	
Hot Pressing	4	4–5		4	
Hypochlorite	5	5		4	
Light	5, 6, 7	6, 6–7, 7		(as grey) 4–5, 4–5, 5 (as black) 7	
Mercerising	—	4–5		3	
Peroxide Bleach	4	4		3	
Soda Boil	4	3–4		3	
Soda Boil (Hypochlorite)	—	Suitable		Unsuitable	
Washing Alteration	—	4–5		—	
Staining	—	5		—	
Remarks					
TEXTILE APPLICATION OTHER THAN COTTON	SILK: Suitable FASTNESS SILK (ISO): Degumming 4 Light —, 6–7, 7 Peroxide 5 WOOL: Substantivity, high FASTNESS WOOL (ISO): Light 7, 7–8, 8 Milling 5 Stoving 4 Washing 5		SILK: Dye weakly acid, adding sodium formaldehyde-sulphoxylate Develop bichromate WOOL: Dye weakly acid, adding ammonium sulphate. Develop bichromate ACETATE: Dye strongly acid, adding sodium formaldehyde-sulphoxylate Develop nitrite		
NON-TEXTILE USAGE					

C.I. Vat Black	Sol. 3	Solubilised 4	Solubilised 5	Solubilised 6	7
C.I. Constitution Number or Chemical Class		—	—	73661	Similar to 59850
Hue Artificial Light		Bluish Grey Redder	Brownish Grey Slightly Browner	Deep Blue→Bluish Black Duller	Green (direct) Black (oxid.) Redder
Reaction with conc. sulphuric acid (on cellulose)					
DYEING Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks	This C.I. Generic Name is discontinued		Poor Dye neutral at 60°C, adding Na_2SO_4 Develop nitrite Also applicable by the one-bath method		1+ 60 60–80 Dark Violet Reddish Brown Moderate Good Pale hues (greys) may be dyed by method 1 Dead cotton only partially covered
PRINTING Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks		✓ ✓ ✓ × × × Direct prints developed chlorate or nitrite	✓ ✓ ✓ × ✓ × Direct prints developed chlorate, nitrite or bichromate Dischargeable in pale hues	✓ ✓ ✓ × ✓ × Direct prints developed chlorate, nitrite or bichromate	× × — × × —
FASTNESS Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks		ISO — — 4–5 (grey) 6, 6–7, 7 (blk) 7–8 — — — — 4–5 —	ISO Good 4–5 4–5 6–7 ($\frac{1}{10}$N), 6–7, 7, — 4 4–5 4–5 Suitable 4–5 5	ISO — — 4–5 6–7, 7, 7–8 — — — — 4–5 —	(Oxidised) ISO 5 5 5 7–8 (as black) 5 4 4 4 5 5
TEXTILE APPLICATION OTHER THAN COTTON			VISCOSE: Apply as cotton SILK: Dye weakly acid, adding sodium sulphoxylate-formaldehyde Develop bichromate WOOL: Dye as silk FASTNESS WOOL (ISO): Light 7 ($\frac{1}{10}$N), 7, 7–8, — Milling 4 Washing 4–5		
NON-TEXTILE USAGE					

8	8:1	Solubilised 8	9	C.I. Vat Black
71000		71001	65230	C.I. Constitution Number or Chemical Class
Blue Grey Slightly duller			Black Redder and duller	Hue Artificial Light
Green			Black, bleeds bluish violet	Reaction with conc. sulphuric acid (on cellulose)
1+, (1) ⩾60 ⩾60 Bluish Green Reddish Brown High Good Sensitive to temperatures above 60°C Dead cotton covered	Purified form of C.I. Vat Black 8	Moderate	1+ 60–50 70–80 Dull Blue Bordeaux High Good Dead cotton covered	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
× × — × × — Poor fixation in direct printing		— — — × × ×	× × × × × —	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
ISO Good 4 4–5 6–7, 7, 7–8 4 5 4–5 Suitable 4 5			AATCC / ISO 5 / Good 5 / 5 4–5 / 4–5 5, 6–7, – (as black 7–8) / 5, 6–7, 7 (as black 7–8) 4 / 5 4–5 / 5 5 / 4–5 4–5 / Suitable — / 4–5 — / 4	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
VISCOSE: Best dyed at 60°C For data on strike, see *JSDC*, **55** (1939) 496 SILK: Suitable FASTNESS SILK (ISO): Degumming 3–4 Light 6, 7, 7–8 Peroxide 5; Washing 5 UNIONS: Good solidity on cotton/viscose dyed cold Cotton greener than viscose at 50°C			VISCOSE: For data on strike, see *JSDC*, **55** (1939) 496 SILK: Substantivity, high; levelling, good FASTNESS SILK (ISO): Degumming 3–4 Light 7–8 (as black) Peroxide 5 Washing 5	**TEXTILE APPLICATION OTHER THAN COTTON**
				NON-TEXTILE USAGE

C.I. Vat Black	10	11	12	13
C.I. Constitution Number or Chemical Class	Anthraquinone	Anthraquinone	Anthraquinone	Anthraquinone
Hue Artificial Light	Greenish Grey→Black Redder	Black	Reddish Grey Unchanged	Greenish Black Redder
Reaction with conc. sulphuric acid (on cellulose)	Brownish Black	Reddish Violet	Green	Dull Reddish Violet
DYEING				
Method	1+ (for blacks), 1 (for greys)	1	1, (2)	1
Vatting Temp. °C	60 (Method 1+), 60 (Method 1)	70	60	60
Dyeing Temp. °C	60–80 (Method 1+), 60 (Method 1)	70	50–60	60
Leuco Alkaline	Reddish Violet	Violet	Reddish Brown	Dull Blue
Acid	Red	Copper Brown	Olive	Dull Bluish Red
Substantivity	Moderate	High	High	High
Levelling	Very good	Moderate	Good	Moderate
Remarks	Rinse immediately after dyeing		Dead cotton covered	
PRINTING				
Direct	×	✓	✓	✓
Coloured Resist	×	✓	✓	✓
White Resist	×	—	—	—
Coloured Discharge	×	✓	✓	✓
White Discharge	×	×	—	—
Flash Ageing	—	—	—	—
Remarks				
FASTNESS				
Testing Method	ISO	AATCC	AATCC	AATCC
Cross Dyeing	4–5	—	—	—
Hot Pressing	5	—	4–5	3
Hypochlorite	5	4	4–5	4–5
Light	(as black) 7	—, 7–8, —	7, 7–8, 8	5, 6–7, 8
Mercerising	5	—	5	3
Peroxide Bleach	4–5	—	4	4–5
Soda Boil	4–5	—	4–5	—
Soda Boil (Hypochlorite)	4–5	—	4–5	—
Washing Alteration	5	—	—	—
Staining	5	—	—	—
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON	SILK: Suitable			SILK: Suitable WOOL: Suitable FASTNESS WOOL (AATCC): Light 6, 7, 8 Milling (III) 4 Washing (III) 3
NON-TEXTILE USAGE				PAPER: Stock colouration

14	15	16	17	18	18:1	C.I. Vat Black
Anthraquinone Reddish Grey Yellower	Anthraquinone Grey Greener	59855 Bluish Grey Duller and redder		Anthraquinone Reddish Grey Redder		C.I. Constitution Number or Chemical Class Hue Artificial Light
Yellowish Green	Dull Olive	Reddish Violet		Dull Blue		Reaction with conc. sulphuric acid (on cellulose)
1 60 60 Brown Greenish Black High Fair	1 60 60 Greenish Grey — High Good	1 50–60 50–60 Violet Dull Red High Moderate Dead cotton covered	This C.I. Generic Name is discontinued	1 60 60 Bluish Violet — High Good	USAGE/PROPERTIES: Similar to C.I. Vat Black 18 Slightly different chemically	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
× × — × — —	✓ ✓ — ✓ × —	✓ ✓ — ✓ × —		✓ ✓ — ✓ — —		**PRINTING** Direct Coloured Resist White Resist **Coloured Discharge** White Discharge Flash Ageing Remarks
AATCC — 3 3–4 6, 6–7, 7 4 4–5 — — — —	AATCC — 4 4 —, 7, — 5 4 — — 5 —	ISO Moderate 3–4 4 6, 6–7, 7 3 4 3 Unsuitable 4 4		AATCC — 5 5 —, 7, — 3–4 4 — — — —		**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
OOL: Suitable ASTNESS WOOL ATCC): Light 5, 5–6, 6 Milling (III) 3 Washing (III) 3	WOOL: Suitable FASTNESS WOOL (AATCC): Light –, 7, – Milling 4 Peroxide 4 Washing 4	VISCOSE: Dyes redder than cotton. For data on strike, see *JSDC*, **55** (1939) 496 SILK: Suitable FASTNESS SILK (ISO): Degumming 3–4 Light 6, 7, 7–8 Peroxide 5 Washing 5		SILK: Suitable WOOL: Suitable		**TEXTILE APPLICATION OTHER THAN COTTON**
						NON-TEXTILE USAGE

C.I. Vat Black	19	20	21	22
C.I. Constitution Number or Chemical Class	Anthraquinone		Anthraquinone	Anthraquinone
Hue	Grey	Bluish Grey	Black	Greenish Grey
Artificial Light	Slightly Greener	Greener		
Reaction with conc. sulphuric acid (on cellulose)			Reddish Black	Olive
DYEING				
Method	1, (1+, 2)	1, (1+, 2)	1	1, (2)
Vatting Temp. °C	60	50	70	60
Dyeing Temp. °C	50–60	60	70	60
Leuco Alkaline	Grey	Violet	Reddish Violet	Bluish Green
Acid	Dull Olive	Ruby	Copper Brown	Dull Purple
Substantivity	High	—	High	High
Levelling	Good	Moderate	Moderate	Good
Remarks	When vatted above 60°C greener dyeings result For method 2, start dyeing without salt	Good coverage of dead cotton		
PRINTING				
Direct	✓	✓	✓	✓
Coloured Resist	✓	✓	✓	✓
White Resist	✓	—	—	—
Coloured Discharge	✓	✓	✓	✓
White Discharge	×	×	—	—
Flash Ageing	—	—	—	—
Remarks				
FASTNESS				
Testing Method	ISO	ISO	AATCC	AATCC
Cross Dyeing	5	4–5	—	—
Hot Pressing	5	4	—	—
Hypochlorite	5	3–4	4	4–5
Light	7–8, 8, 8	7, 7–8, 7–8	—, 8, —	6, 7, 8
Mercerising	5	4	—	4–5
Peroxide Bleach	5	4	—	5
Soda Boil	5	4	—	—
Soda Boil (Hypochlorite)	Suitable	Unsuitable	—	—
Washing Alteration	4–5	4–5	—	—
Staining	5	5	—	—
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON			SILK: Suitable WOOL: Suitable	
NON-TEXTILE USAGE				

23	23:1	24	25	25:1	Solubilised 25	C.I. Vat Black
65260		Anthraquinone	69525			C.I. Constitution Number or Chemical Class
Grey Yellower		Grey Unchanged	Brownish Grey Greener			Hue Artificial Light
Dull red, bleeds red violet		Dull Violet				Reaction with conc. sulphuric acid (on cellulose)
1 60 60 Dull Reddish Violet	USAGE/PROPERTIES: Similar to C.I. Vat Black 23 Slightly different chemically	Violet Dull Yellowish Red	1, (1+) 60 50–60 Grey Dull Olive High Moderate Dyes browner above 60°C. When dyeing in short liquor use method 1+ Dead cotton well covered	USAGE/PROPERTIES: Similar to C.I. Vat Black 25 Slightly different chemically	Moderate Dye neutral or weakly alkaline, adding NaCl Develop by nitrite	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
		✓ ✓ — ✓ — —	× × — × × — Poor fixation in direct printing		✓ ✓ — × × ×	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
ISO 4–5 4 4 6, 6–7, 7 4 4 3 Unsuitable — —		ISO — 4 3 7, 7–8, 7–8 5 2 2 Unsuitable 4 5	AATCC / ISO 5 / 5 5 / 4 4 / 4 7–8, 7–8, 8 / 7–8, 8, 8 5 / 5 4–5 / 4 5 / 4–5 — / 5 — / 4–5 — / 5			**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
VISCOSE: Dyes redder than cotton			SILK: Suitable FASTNESS SILK (ISO): Degumming 4 Light 7, 7–8, 8 Peroxide 5 Washing 5 WOOL: Suitable FASTNESS WOOL (AATCC): Light 7, 7–8, 8 Milling 3–4 Washing 4–5		SILK: Dye weakly acid, exhausting formic acid Develop by bichromate WOOL: As silk	**TEXTILE APPLICATION OTHER THAN COTTON**
PAPER: Stock colouration						**NON-TEXTILE USAGE**

C.I. Vat Black	26	27	28	29
C.I. Constitution Number or Chemical Class	Anthraquinone (main component)	69005	65010	65225
Hue Artificial Light	Reddish Black	Brownish Grey Redder	Grey Redder	Bluish Grey→Navy Greener
Reaction with conc. sulphuric acid (on cellulose)	Bluish Black	Dull Red	Olive	Yellowish Green
DYEING				
Method		2, (1, 3)	3	2, (3)
Vatting Temp. °C		50	45–50	50–60
Dyeing Temp. °C		45–50	25	45–50
Leuco Alkaline		Reddish Brown	Reddish Brown	Bordeaux
Acid		Yellowish Brown	Yellowish Brown	Yellowish Brown
Substantivity		High	Moderate	Moderate
Levelling		Very good	Moderate	Very good
Remarks		Dead cotton covered moderately well For report on strike, see *JSDC*, **66** (1950), 505		
PRINTING				
Direct	✓	×	×	✓
Coloured Resist	✓	×	×	✓
White Resist	—	—	—	—
Coloured Discharge	✓	×	×	✓
White Discharge	—	✓	✓	✓
Flash Ageing	—	—	—	✓
Remarks		Poor fixation in direct printing	Dischargeable in pale hues Poor fixation in direct printing	Dischargeable in pale and medium hues
FASTNESS				
Testing Method	AATCC	AATCC ISO	ISO	ISO
Cross Dyeing	—	5 5	Good	5
Hot Pressing	5	3 3	3	4
Hypochlorite	4	4–5 4–5	4	4
Light	—, 8, —	6–7, 7, 7–8 6–7, 7, 7	6–7, 6–7, 7	5, 6, 6–7
Mercerising	—	4 4–5	5	3–4
Peroxide Bleach	4	4–5 4–5	4–5	4–5
Soda Boil	—	5 4–5	4	4
Soda Boil (Hypochlorite)	—	4–5 5	Suitable	4
Washing Alteration	—	— 4–5	—	4–5
Staining	—	— 4–5	—	5
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON		VISCOSE: Dyes greener than cotton. For data on strike, see *JSDC*, **55** (1939), 481 SILK: Substantivity, high; levelling, good FASTNESS SILK (ISO): Degumming 4 Light 6, 6–7, 6–7 Peroxide 5 Washing 5 WOOL: Low substantivity		SILK: Suitable FASTNESS SILK (ISO): Degumming 4 Light 5–6, 6–7, 7–8 Peroxide 5 Washing 5 UNIONS: Good solidity on cotton/viscose
NON-TEXTILE USAGE		PAPER: Stock colouration		PAPER: Stock colouration

30	31	32	33	C.I. Vat Black
Anthraquinone Reddish Grey Slightly Redder	Anthraquinone Bluish Grey Redder	Anthraquinone Grey Slightly Redder	Anthraquinone Brownish Grey Redder	C.I. Constitution Number or Chemical Class Hue Artificial Light
				Reaction with conc. sulphuric acid (on cellulose)
2, 3, (1) 50–60 40–50 Dull Reddish Brown Yellowish Brown Low Good **Method 1, suitable for shading only**	2, (1, 3) 50 50 Dull Violet Reddish Brown Moderate Very good	2, (1) 50 50 Dull Bordeaux Yellowish Brown — Very good	3 40–50 40–50 Dull Orange Dull Yellowish Brown — Good Dead cotton covered	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
✓ × — × × ✓ **Moderately suitable for direct printing when pre-reduced and sodium benzyl-sulphanilate added**	— — — — ✓ — Dischargeable in pale hues	— — — — ✓ — Dischargeable to white in pale hues	✓ ✓ — ✓ × —	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
ISO 4 4 4 6–7, 7, 7 4 4–5 4 4 4–5 5	ISO — 5 4–5 6–7, 7, 7 4–5 5 4 Suitable 4–5 5	ISO — 4–5 4 5, 6, 6–7 4 — 4 Suitable 4–5 5	ISO — Good 4–5 6–7, 7, 7 4–5 4 4–5 4 5 5	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
SILK: Suitable VISCOSE: Best dyed at 80°C. Low substantivity at low temperature	UNIONS: Good solidity on cotton/viscose	UNIONS: Good solidity on cotton/viscose	VISCOSE: Unsuitable SILK: Unsuitable	**TEXTILE APPLICATION OTHER THAN COTTON**
				NON-TEXTILE USAGE

C.I. Vat Black	34	35	36	37
C.I. Constitution Number or Chemical Class	Anthraquinone	73660	Anthraquinone	Anthraquinone
Hue Artificial Light	Black	Greenish Grey→Black Slightly Greener	Bluish Blacker Blacker	Greenish Grey
Reaction with conc. sulphuric acid (on cellulose)			Reddish Blue	Green
DYEING				
Method	1			1
Vatting Temp. °C	60			50–60
Dyeing Temp. °C	60			50–60
Leuco	Bluish Black			Dark Grey
Alkaline	Dull Bluish Red			Dark Bordeaux
Acid	High			High
Substantivity	Moderate			Good
Levelling	Dead cotton covered moderately well			Good stability to high temperature dyeing
Remarks	Not suitable for greys			
PRINTING				
Direct		✓	✓	
Coloured Resist		✓	✓	
White Resist		—	—	
Coloured Discharge		✓	✓	
White Discharge		—	×	
Flash Ageing		—	—	
Remarks				
FASTNESS				
Testing Method	ISO	ISO	AATCC	AATCC
Cross Dyeing	5	—	—	—
Hot Pressing	4	—	4–5	4–5
Hypochlorite	5	5	4	4
Light	—, 6–7, 6–7	7–8 (as black)	7, 7, 8	5, 6–7, 7–8
Mercerising	5	—	4–5	4–5
Peroxide Bleach	5	4–5	4–5	4–5
Soda Boil	5	—	—	—
Soda Boil (Hypochlorite)	5	—	—	—
Washing Alteration	5	4–5	4–5 (III)	4–5 (III)
Staining	3–4	4–5	5 (III)	5 (III)
Remarks				
TEXTILE APPLICATION OTHER THAN COTTON				
NON-TEXTILE USAGE				

38	39	40-43	44	45-51	52	C.I. Vat Black
Anthraquinone Bluish Grey→Bluish Black	Anthraquinone Black		Anthraquinone Grey		Reddish Black	C.I. Constitution Number or Chemical Class Hue Artificial Light
Violet	Redder		Grey		Reddish Violet	Reaction with conc. sulphuric acid (on cellulose)
1 50–60 50–60 Dark Violet Reddish Brown Very high Moderate Good stability to high temperature dyeing		These C.I. Generic Names are discontinued	1 70–80 50–60 Dark Brown Brownish Olive Very high Good May be vatted in long or short liquors Poor coverage of dead cotton	These C.I. Generic Names are discontinued	1 60–80 47–60 Dark Violet — — Good	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
✓ ✓ — ✓ — —	✓ ✓ — ✓ × —		✓ ✓ — ✓ × —			**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
AATCC — 4 3–4 5–6, 7, 8 4–5 3–4 — — 3–4 (III) 4–5 (III)	ISO — 5 4–5 —, 7–8, — — 4–5 — — 4–5 4–5		ISO 4–5 3–4 4–5 7, 7, 7–8 4 4–5 4–5 Suitable 5 5		AATCC — — — 6–7, —, 8 4–5 4 — — 4 —	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
			SILK: Suitable method 2 FASTNESS SILK (ISO): Degumming 5 Light 5–6, 6, 6–7 Peroxide 4–5			**TEXTILE APPLICATION OTHER THAN COTTON**
						NON-TEXTILE USAGE

C.I. Vat Black	53	54	55	56	57
C.I. Constitution Number or Chemical Class				Anthraquinone	Anthraquinone
Hue Artificial Light	Bluish Grey	Reddish Grey		Bluish Grey	Reddish Grey
Reaction with conc. sulphuric acid (on cellulose)	Dull Green	Bright Green			
DYEING			This C.I. Generic Name is discontinued		
Method	1+	1+		1, (2)	2, (1)
Vatting Temp. °C	60	60		50–60	50–60
Dyeing Temp. °C	60	60		50–60	45–50
Leuco Alkaline	Greyish Blue	Reddish Grey		Dull Blue	Dull Bluish Violet
Acid	—			—	
Substantivity	High			—	
Levelling	—			Good	
Remarks					
PRINTING					
Direct				✓	✓
Coloured Resist				✓	✓
White Resist				—	—
Coloured Discharge				✓	✓
White Discharge				×	×
Flash Ageing				—	—
Remarks					
FASTNESS					
Testing Method	AATCC	AATCC		JIS	JIS
Cross Dyeing	—	—		—	—
Hot Pressing	—	—		4	4
Hypochlorite	—	—		2–3	4
Light	—, 4–5, —	—, 6–7, —		7, 7, 7–8	6–7, 7, 7
Mercerising	—	—		4	4–5
Peroxide Bleach	3	4–5		3–4	4–5
Soda Boil	—	—		4	4–5
Soda Boil (Hypochlorite)	—	—		—	—
Washing Alteration	4–5	4–5		4–5	4–5
Staining	—	—		5	5
Remarks					
TEXTILE APPLICATION OTHER THAN COTTON					
NON-TEXTILE USAGE					

58	59,60	Solubilised 61	62	C.I. Vat Black
Anthraquinone Black		Anthraquinone Black	Anthraquinone Bluish Grey Yellower	C.I. Constitution Number or Chemical Class Hue Artificial Light
				Reaction with conc. sulphuric acid (on cellulose)
1+, (1) 50–60 55–60 Dull Bluish Violet — — Moderate	These C.I. Generic Names are discontinued	Pad application	1+, (2) 50 45–115 Violet Reddish Brown High Good Moderate coverage of dead cotton	**DYEING** Method Vatting Temp. °C Dyeing Temp. °C Leuco Alkaline Acid Substantivity Levelling Remarks
✓ ✓ — ✓ × —		✓ ✓ — × — × Direct prints developed by nitrite or sulphocyanide	— — — — ✓ —	**PRINTING** Direct Coloured Resist White Resist Coloured Discharge White Discharge Flash Ageing Remarks
JIS — 3 4–5 7–8, 8, 8 4 4 4 — 4–5 5		ISO — — 4–5 7 (as black) — 4–5 — — 4–5 —	ISO 4–5 4–5 4 6–7, 6–7, 7 4–5 4–5 4–5 Suitable — —	**FASTNESS** Testing Method Cross Dyeing Hot Pressing Hypochlorite Light Mercerising Peroxide Bleach Soda Boil Soda Boil (Hypochlorite) Washing Alteration Staining Remarks
		SILK: Suitable WOOL: Suitable		**TEXTILE APPLICATION OTHER THAN COTTON**
				NON-TEXTILE USAGE

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